FUZZY ANALYSIS OF SCHOOL DROPOUTS AND THEIR LIFE AFTER

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PREFACE

In this book authors study and analyze the problem of school dropouts and their life after. The problems can by no means be analyzed by collecting the numerical data. For such data can only serve as information beyond that the data can be of no use, for the school dropouts suffer an environment change after becoming a school dropout. Thus the emotions of the school dropout; is technically involved.

A school dropout can be a child labourer, a rag picker or a social miscreant or be in police custody or be in a rehabilitation home if he/she is a runaway. The story is entirely different if the child is a school dropout due to abduction. In the case of female children the problem is more serious for they are sexually exploited and in most cases they land up in brothels as prostitutes. Thus their life after is a complete misery for these children not only have been denied the right to enjoy their childhood but from a very young age they are sexually exploited and invariably the majority of them become victims of sexually transmitted disease or suffer from cervical cancer or suffer from AIDS/HIV with no one to take care of them. Majority of these children die as orphans. Who is responsible for all these? Who is going to take up their issue? The question has no answer and the life after for these female children is a misery.

The school dropout of female children due to child marriage is entirely another issue, for in most cases they are married to men four times their age. They suffer a very different type of orthodoxy associated with Indian culture and heritage. All this is seconded by Laws of Manu for a women is only an object so without any objection they can do anything to it. That is why the popular daily, The Times of India reports “27% spike in procurement of minor girls”. So they have once again justified women are just objects sold or thrown away for their convenience. This book does not study the female dropout and their life after.

In this book we do not deal with school dropouts who are mostly male children who are trained as miscreants or killed for organ trade. We deal only with those school children who become child labourers or beggars or rag pickers and so on. We have used fuzzy models to study the collected data from these school dropouts. Several fuzzy models are used in this study. At this juncture the authors want to keep in record all the opinions are from researchers, teachers, educationalists, parents, socio-scientists, school dropouts themselves and public. The authors have only processed the data using mathematical models to obtain suggestions to save these school dropouts and to minimize the school dropouts.

From our study to control or minimize the school dropout if teachers are devoted to their profession it can reduced. Another striking reason for school dropout is poverty. We are eradicating poverty for 6 decades yet rich is becoming richer and poor poorer. Only when this changes school dropouts can be reduced. For our study revealed that most of the school dropouts who are child labourers work for a monthly wage of 600 to 700 rupees, to save the family from starvation. Who is to be blamed for this? Finally we thank research students, teachers, socio scientists, school dropouts, parents, school children and many more who made this endeavour a success.

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Chapter One

INTRODUCTION

In this book authors mainly study the problems faced by the school dropouts and their life there after. School dropouts can be due to teachers harshness or the child feelings wounded by the teachers actions, due to family problems, due to parents forcing them for child labour or marriage (in case of girl children), sudden death of earning members, migration of parents seeking for better livelihood, abduction of children, children lost or missing (13 lakh children go missing every year in India; Sunday Times of India, Chennai, October 7, 2012) and Child murder. Of course we cannot work with the case of child murder as they have no life after. Further we have taken a case study of about 700 school dropouts from both rural and urban areas. When the school dropout from the rural area stays in his home and their profession is agriculture then usually the school drop out becomes a very capable person in taking care of the land and educating the other siblings. This is the case when the school dropout discontinues his study due to the problem from school or teacher. However if the school dropout from the school is due to family problems even in rural areas even if he stays at home the life after is a problem. If he is a run away to city or other places the problem is of different kind and dimension. For this type of school dropout where family is a problem and that is the cause of discontinuing studies may run away from home. This case will be dealt with later. If they

continue to be in their home they in most cases become a bad personality by believing his gang of bad company whom he has developed to be the main source of his life and their by doing petty theft, alcohol to rape and murder. It is pertinent to record a bad home atmosphere in most of the cases produces a culprit or a person with bad qualities.

This is so far with school dropout in rural areas. Now what is the speciality of the school dropout in urban and in semiurban areas. In most cases if they discontinue their studies due to family problem and continue to live with the family they in most cases become the miscreants or rowdies. If they are also runaways to other states they may survive for a span of maximum two decades and die of some contagious diseases or suffer dangerous health hazards or be involved in crimes and be in prison.

On the other hand if they seek interest in some good job and support the family it is a welcome change in them. This occurs at a very low percentage. Of course there are such good cases but countable or very less in comparison with the number of school dropouts.

The other type of dropouts are children who are lost or missing or abducted. In some cases they join their parents in many cases they die as an orphan. This happens to girls for in many cases they are made to work as prostitutes or as call girls and they loose the track of their family and die of some sexually contracted diseases including HIV/AIDS.

Further when minor girls are married off they also become school dropouts and their life in most cases is drudgery for they lead a life of slave.

Now we give some of the information from print media about the school dropouts and their life after.

Missing link in Lost kids Deep Focus - Sunday Times of India, Chennai, Dec. 7, (2012). 13 lakh children go missing in

India every year. Many of them can be reunited with their rightful parents if we have a special DNA data bank in place. A forensic geneticist in Spain has successfully launched the programme in many countries. Why can't we do it here when the idea has been there since 1998?

It was a strange phone call, says Anuj Bhargava. A man called Arun was calling from Belgium. Sometime in the '80s said Arun he had been sold for $8000 to a Belgian couple by an orphanage in Chennai. He had an old photograph with him, of him and a man, the man who had abducted Arun from his family.

Could Anuj help find his family? Anuj, a trustee of the NGO National Centre for Missing Children, called his local newspaper in Indore asking whether they had a correspondent in Chennai and if he could track down Arun's family. Soon a woman who claimed to be Arun's mother was found. But only a few weeks later, Arun called back to say the search should be called off. Apparently the police had begun to harass the woman.

Anuj wonders how much longer this will carry on. His website missing Indian kids computes up pictures of missing children from around the country, asking viewers to take printouts and put them up. So far in 10 years the website has been able to reunite just six children with their parents when the government puts the figure at 12 to 13 lakh missing children every year.

Whatever be the DNA what is the purpose served in uniting them?

This question remains a riddle till date!

Rishi Kant of the NGO Shakti Vahini talks about starting an emergency number on which worried parents would report the loss of child. His NGO then will watch out for these chidren in the railway stations of Delhi and Mumbai, the major distribution points of trafficked children.

Kant who talks about a 16 year old girl being rescued from Delhi home of a doctor couple on Friday - she'd been abducted as a four year old and for the last year the doctor had been sexually abusing her while his wife had been feeding her anti pregency pills say his team harangues the police every day to raid another home.

Getting the girl to her parents is a different story.

The Times of India, Chennai, Monday, July 9, 2012. Tamil Nadu Ranks 3rd in Child murders. 3 Southern states in Top 5 list.

Coimbatore: The latest figures released from the national crime records bureau indicate a disturbing trend in Tamil Nadu as the state ranks third in the number of children (upto 10 years) found murdered. Maharastra tops the list 141 followed by Uttar Pradesh with 96 and Tamil Nadu with 90 child victims. We can claim them to be only school dropouts but we have nothing to talk about life there after.

What a school dropout can mean even at the age of 14 years?

Reported from Times News Network, Trichy. Minor tries to molest 7 year old girl, held.

Police have arrested a 14 year old boy who allegedly attempted to sexually abuse a seven year old girl in a village near Trichy on Saturday. The boy has been sent to a juvenile home.

The girl a class 2 student in a government school is one of the three daughters of a couple Maalvai village in Trichy. The boy a school dropout from the same village hawked fruits in the area.

The girl and her two sisters were playing along with other children. The boy tried to lure her with fruits. Her sisters saw this and warned him. When they ran home to get the parents

leaving the girl at the spot he tried to abuse her sexually", said police inspector V. Ilanchezhian. "But she managed to escape from him and ran home. She was old enough to understand what he was trying to do to her. Her parents hunted for him but he had fled the spot", the inspector said.

The girl was admitted to a government hospital in Trichy for medical examination on Saturday night, said Ilanchezhain. Police was awaiting the medical report. The boy has confessed that, he tried to force himself on her, the officer said. This is the plight of school dropouts in villages when they wander in the village aimlessly at 14 years, thinks of raping a 7 year old.

Another instance reported from Mumbai, reported in Times of India, where a 16 year old school dropout is suspected to have murdered a 19 year old boy.

Four minors, teen murder youth who protested harassment of a girl.

Man who tried to save him stabbed. Mumbai. In a chilling replay of the Amboli eve-teasing horror; four minor boys and their 18 year old friend stabbed a youth to death at the gate of his housing complex here for protesting the lewd comments passed at a girl. They also injured a person who tried to help the victim late on Monday evening.

The five have been arrested for murder and rioting; the four minors will be presented in a juvenile court on Wednesday. Around 9-45 pm on Monday Santhosh Vichivara (19) was returning from work and took a private bus to his Navneet Nagar complex from Dombivile station.

Also abroad was a girl who stayed in his complex and was returning from tuitions. Once they alighted the five accused who were hanging around the colony's gate targeted the girl with vulgar comments.

Three of the minors aged 16, 17 are in school. A 16 year old dropout is suspected to be the main assailant. Pankaj Raj 18 is studying for his HSC examination.

Santosh was irked and when one of the eve-teasers asked for the girl's cell phone number, he confronted them. He asked them to leave the colony gate and an argument ensued. The girl hurried inside and told Santosh to avoid a dispute as the boys who stayed nearby were known miscreants. But Santosh who worked in a shop stood his ground and told them he did not want to see them again at the complex gate. At this the boys attacked him and started beating him up. One of them took out a knife and stabbed him again.

In Dombivli society member Jayantilal Gada 50 saw the scuffle near the gate and ran to help Santosh. The boys attacked him too with the knife. Initially when I saw the accused chasing Santosh I thought they were man handling him. "But when I went close one of the boys attacked me with a knife. I suffered injuries to my hand" said Jayantilal who is recovering. By now the melee had alerted residents many of whom rushed out on.

The boys fled "Seeing Santosh bleeding heavily we called an autoriskshaw and took him to the near by Arogyam hospital. "The doctor declared him dead on arrival", said Manoj Gosar a resident of the society.

Later the residents approached Manpada police who filed a murder and rioting case and started a hunt for the accused. "The girl who was being harassed gave us clues about the accused and described them to us. We have arrested them from different places through the night," said. Indrajeet Karle inspector at Manpada police station.

It was reported in Times of India. 'Child marriage cases on the rise in Madurai district. Madurai: A rise in child marriage case in Madurai district has prompted officials to look into the social reasons contributing to the trend.

Between January and July this year 15 cases of child marriages were reported in Madurai district. Officials were able to stop 10 such incidents.

Most incidents indicated that parents want to get their underage daughters married off as they fear that they would fall in love and choose their own life partner. "Do you know how risky it is to have an abolescent girl at home? It will bring disgrace to my family if she falls in love and elopes with some one, says Raju (name changed) from Uchapatti near Usilampatti who is facing charges of marrying off his minor daughter in Madurai. Lack of educational and job opportunities for girls are other reasons cited.

"As there are not many government run schools for girls in the Usilampatti region, parents feel that marrying them off is a better option".

V. Balakrishnan district SP said they have initiated criminal action against parents who tried to get their underage daughters married.

"There is also a fear among parents about their daughter falling in love with men from different caste," he said.

This is one of the passive ways which increases the school dropout in girls. Their life after is well known to society; child bearing and house hold working machine.

Times News Network reports 62 child labourers rescued in Erode.

Erode: A day after the district administration and police rescued more than 77 bonded labourer, including 30 children from an illegal yarn processing mill at Karungalpalayam near Erode, a spinning mill in neighbouring Sollar on Tuesday took 62 child labourers to a temple about 27 km away to spend the day there to avoid a possible crackdown by the authorities. However the move backfired when residents became suspicious

about the presence of such a huge group at the remote Mannathanpalayam temple and questioned them. On finding they were child labourers, they informed police and revenue authorities who reached the spot and rescued the children.

According to district collector V.K. Shanmugham the authorities had announced a district wise crack down against child labour on Monday soon after the rescue of 30 children.

Fearing prosecution the management of Dhanalakshmi spinning mill at Sollar has taken all its 62 child labourers to the temple at around 9 am in a van. The mill authorities told the children to spent time in the temple till evening.

District revenue officer S. Ganesh visited the spot and took the children to a rehabilitation home where they are currently lodged. Among 62 children 40 were girls and 22 boys; all below 14 years. While eight belonged to erode and 10 were from Chamarajanagar in Karnataka. Lokomma 12 from Chamarajangar told TOI that it was poverty that prompted her mother to leave her at the mill six months ago. She said she was the sole breadwinner for the family including one elder brother and a younger brother.

Several report come in print media of the news about the child labourers being freed. But what is their future plans? A complete answer is yet to be found!

Times in India reports 27% spike in procurement of minor girls"

New Delhi, India is fast earning itself the dubious distinction of being a country unsafe for its children with an alarming 24% increase in crimes against them in 2011 compared to previous year, according to the latest; "Children in India 2012", report.

The last time such a report on the state of India's children came out was in 2008.

The report said, “the analysis of crime and children as presented here, puts forward a few upsetting revelations about the child offenders, which points out to the vulnerable conditions of children that need to be addressed urgently especially poverty”.

India’s chief statistician T.C.A. Anand said in the report “even today after six decades of independence, the condition of children remains a cause of concern in the country. As the statistics speaks out loudly, we have miles to go to ensure a bright future for the children in all spheres of their life”.

According to the report procurement of minor girls saw a 27% spike-862 cases in 2011 compared to 679 cases in 2010. West Bengal reported the highest chunk of these cases (298) - a share of 34.6% followed by Bihar (183), Assam (142) and Andhra Pradesh (106).

The average charge - sheeting rate for all crimes against children was 82.5% in 2011 which are the same in 2010 as well.

The highest charge sheet rate was observed in cases under ‘buying of girls for prostitution’ (100%) followed by rape (97.3%) in comparison to the prevailing national level charge sheeting rate of 78.8% for the IPC crimes. The lowest charge sheet rate was found in female foeticide.

Further the highest increase in the incidence of juvenile crimes was observed. The 2012 data show that juvenile IPC crimes in 2011 increase by 10.5% over 2010 as 22,740 IPC crimes by Juveniles were registered during 2010 which increased by 25,125 cases in 2011.

Now this report clearly shows two main factors.

Are young girl’s commodities or are they accepted as living human beings? This is the first disturbing and humiliating fact about the female’s at large. It is unethical in the first place. We are back to the days of rule by Manu for in laws of Manu alone

'women' is termed / treated as an object. Are we civilized? Is our civilization in IT research parks and in producing IT professionals alone and not treating women with dignity?

The second question is "Who are these juvenile offenders?" Are they the school dropouts?

We do not try to analyse these questions mathematically in this book using fuzzy models.

Another observation is that unless demand for prostitutes exists there cannot be such a high rate of supply." One really feels disgraced at the grim situation of girls sold for prostitution! "Where are we leading to?" is a very sensitive but a painful and depressing question.

Times of India reports, 16 abducted baby girls rescued from highway brothels in Madhya Pradesh.

Bhopal: Sixteen girls, aged between two and seven were rescued by the police from brothels lining the highways in Mandsaur in Madya Pradesh in the past five days.

These girls were abducted from their homes and sold for Rs. 10,000 to Rs. 60,000 to flesh traders of the 'Bachhra' tribe. The little girls were being held in captive so they could join the traditional occupation of the Bachhras as soon as they entered puberty. Bachhras are one of the most backward tribes of the country residing in the districts adjoining Rajastan.

While their men do not work the women are made to earn for the community through prostitution. Bachhras are known specially for child prostitution with families pushing their first daughters into the profession.

During a raid on a brothel house earlier this week, the police saw some little girls who did not appear to be belonging to the Bachhra families.

Then they came to know of abduction and imprisonment of the children. "It was generally known to us that women of the Bachhra tribe involved themselves in prostitution for a living. But what is alarming is that female infants from adjoining districts are being kidnapped so they may join the flesh trade and earn for the tribe", additional SP Pankaj Shrivastava said.

The police have located the parents' families of nine girls and have handed over their daughters to them. The other children have been sent to a shelter home.

The police said many of the rescued girls had been in captivity for several months or even for more than a year.

It is reported by the Times News Network.

318 children rescued in 2011.

The Juvenile Aid Police Unit rescued 318 children in 2011, 100 more compared to 2010. Of the 318 children rescued by the police 219 were boys and 99 girls.

Of the rescued children, 39 were returned to their parents and guardians. 153 boys and 60 girls who needed security were handed over to the Chennai; Child Welfare Centre after filing first information reports (FIR). After investigation, 72 boys and 36 girls from these were handed over to their parents. 22 children from other states are handed over to their respective child welfare centres.

Of the 318 rescued 196 children were found wandering around, 62 were begging and 60 were doing business on streets.

Sunday Times of India, Chennai, July 22, 2012 reports,

Woman held for abducting 6 year old to beg on trains.

Coimbatore: A 40 year old sex worker was arrested on Friday on charges of abducting a six year old girl in city. Police

said the woman had asked her acquaintance to kidnap a girl, who she could use for begging on trains. The woman later planned to push her into the sex trade, police said.

K. Meenakshi alies Aarathal of Suleeswaranpatti near Pollachi sought help from S. Selvam, 32 and his friend V. Subramani 35 both hailing from Dindigul district to kidnap a girl. On July 9 the duo abducted the class I student of Velandipalayam around 4.30 pm.

The girl was kidnapped when she came out of her school in Kovilmedu. Initially they took her to a hotel in Flower Market and fed her an ice cream. Later they took the girl to Palakkad in Kerala by a train. When she said she was hungry, they got off the train at Olvakkhode near Palakkad and took the girl to a restaurant. When the girl began crying for her mother in the restaurant, the people there grew suspicious and rescued the girl. While they nabbed Selvan, Subramani escaped.

Police said Selvam came to Kerala looking for a job and worked in various hotels. He met Meenakshi with whom he had an affair in Palakkad as she often visited the place. Four months ago Meenakshi told him that she wanted a girl for begging as she was getting old. Following this Selvam and his friend Subramani hatched a plan to kidnap a girl. Based on Selvams confession, police arrested Subramani on July 15 and Meenakshi on Friday. She was remanded in judicial custody.

Boys sold by mother refuse to go back. Times News Network. Ramanathapuram. Two boys who were allegedly sold by their mother to a cattle herd owner in Ramanathapuram district a year ago and rescued recently have preferred to stay in a government home rather than join their mother.

The boys have also expressed their interest to pursue studies, we have sought written consent from the mother to allow her sons to stay in the welfare home and pursue studies. She sought permission to visit her sons once a month said A. Manimegalai district social welfare officer.

The two boys Kumar (12) and Muniswaran (9) were allegedly sold by their mother Eluvakkal to her relative Murugesan due to poverty after her husband died. Murugesan forced the boys to work in his farm at Sevvur village and take care of the cattle.

"After spending more than a year the boys managed to escape two weeks ago. They were roaming in Sevvur bus stand when they approached a women and sought money from her as they were hungry.

The woman Veerammal from Erode district enquired about the boys and them with her," said a social welfare department official.

Murugesan traced the boys to Veerammal's house and demanded that they be sent with him. A worried Veerammal instead sent the boys with her son Saravanan to the district collectorate in Ramanathapuram on June 18.

Another important factor which drastically increases the school dropout is the number of child migrants. These children in some cases come with their parents in some cases they are run aways from home in some cases due to poverty their parents send them to job contractors (middle men) to other places seeking for jobs.

It is reported in The Hindu Tuesday December 20, 2011, "Number of child migrants to state on the rise", Chennai. A large number of children from villages and small towns, including from other states are migrating to cities in Tamil Nadu, in search of a better living said Umi Daniel head, Migration Thematic Unit of Aide et Action International.

Speaking at a state-level workshop on 'Education and protection of migrant children' here on Monday, Mr. Daniel said in the name of skill development many youngsters are being brought to the state and trained, but they are treated shabbily. "Those employed in brick kilns receive the worst treatment and children working in rice mills are one among the

most prevalent group of migrants in the state," he said. Besides poverty and household problems, natural calamities and conflicts are emerging as new factors driving this migration. A good majority of the youngsters, he added are moving out of their native place on their own.

Several causes supplementing the migration was given. Our study is how to solve this problem of school drop out. For even after they migrate in some cases they also become miscreants indulging in theft and murder. However children being employed is a crime and it by no means can be compromised.

Finally we see how the school dropout in the city indulge in petty theft and so on.

Times of India reports. Bell stolen from Theosophical society found, 4 juveniles held. Chennai. Two days after a huge bell was stolen from the Lord Buddha temple on the Theosophical society campus in Adyar police on Friday arrested four juveniles all from Olcott kuppam and Ooprur kuppam near Thiruvanmiyur in this connection. The 50 kg bell was found among bushes on the banks of the Adyar. A hunt is on for another juvenile. This juvenile crimes are increasing.

Finally we give some positive notes about the school dropouts. The Hindu Saturday May 28, 2011 reports as follows: Former child labourers emerge with flying colours. Uma Maheswari rescued from silver anklet unit, scores 485/500.

Chennai: A group of students once child labourers and denied their right to education emerged successful on Friday in the class X examination. Over 700 students from Tuticorin, Combatore, Krishnagiri, Vellore Dharmapuri, Erode, Salem and Virudhunagar cleared their class X examinations this year.

Thus we have seen a very few news from the print media related with school dropouts, consequent child labour, run away school dropouts indulging in rape, theft and murder and finally small girls sold, abducted and missing who have never entered the school premises with a promised profession of prostitution.

Chapter Two

BASIC CONCEPTS

The basic tools used in the analysis of the problem of school dropout and their life after are described briefly in this chapter. We provide also the references for these concepts.

Bart Kosko introduced the Fuzzy Cognitive Maps (FCMs) in the year 1986. Fuzzy Cognitive Maps are fuzzy structures that strongly resemble neural networks, and they have powerful and far-reaching consequences as a mathematical tool for modeling complex systems. FCM was a fuzzy extension of the cognitive map pioneered in 1976 by political scientist Robert Axelord, who used it to represent knowledge as an interconnected, directed, bilevel-logic graph.

FCMs are fuzzy signed directed graphs with feedback. In a directed graph, the concepts C_i and C_j are taken as vertices and the edge e_{ij} from causal concept C_i to concept C_j measures how much C_i causes C_j.

FCMs models the world as a collection of classes and causal relations between classes.

The edges e_{ij} takes the values from the set {–1, 0, 1} as follows:

e_{ij} = 0 indicates no causality between C_i and C_j

> 0 indicates causal increase; C_j increases or decreases as C_i increases or decreases respectively

< 0 indicates causal decreases or negative causality;

that is, C_j decreases as C_i increases or C_j increases as C_i decreases.

Simple FCMs have edge values in {–1, 0, 1}. Thus if causality occurs, it occurs to maximal positive or negative degree. Simple FCMs provide a quick first approximation to an expert's stated or printed causal knowledge.

Consider the nodes or concepts $C_1, C_2, \ldots, C_n$ of the FCMs. Suppose the directed graph is drawn using edge weight $e_{ij} \in \{-1, 0, 1\}$. The matrix E be defined by $E = (e_{ij})$, where e_{ij} is the weight of connection matrix of the FCM.

It is important to note that all matrices associated with an FCM are always square matrices with diagonal entries as zero.

$A = (a_1, a_2, \ldots, a_i)$ where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denotes the on-off position of the node at an instant.

a_i = 0 if a_i is off

= 1 if a_i is on, where i = 1, 2, …, n.

An FCM is said to be cyclic if it possesses a directed cycle and is said to be acyclic if it does not possess any directed cycle. An FCM with cycles is said to have a feedback.

When there is a feedback in an FCM, the FCM is called a dynamical system.

Let $\overline{C_1C_2}, \overline{C_2C_3}, ..., \overline{C_iC_j}$, be a cycle. When C_i is switched on and if the causality flows through the edges of a cycle and it again cause C_i, we say that the dynamical system goes round and round. This is true for any node C_i, for i = 1, 2, …, n. The equilibrium state for this dynamical system is called the hidden pattern.

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. If the FCM settles down with a state vector repeating in the form $A_1 \to A_2 \to \ldots \to A_i, \ldots, \to A_1$, then this equilibrium is called a limit cycle.

Finite number of FCMs can be combined together to produce the joint effect of all FCMs. Let $E_1, E_2, \ldots, E_p$ be adjacency matrices of the FCMs with nodes $C_1, C_2, \ldots, C_n$, then the combined FCM is got by adding all the adjacency matrices $E_1, E_2, \ldots, E_p$.

The connection matrix $M = (m_{ij})$ is the adjacency matrix with $C_1, C_2, \ldots, C_s$ as vertices and its entries $m_{ij} = e_{ij}$. We pass state vector C_1 repeatedly through the FCM connection matrix M. Equilibrium in this system is attained when we have a set of repeated patterns. Repeating patterns can be fixed points or limit cycles. A fixed point is a single recurring pattern such as, $C_3 \Rightarrow C_3$ in the pattern $C_1 \Rightarrow C_2 \Rightarrow C_3 \Rightarrow C_3$.

A “limit cycle” is a set of multiple repeating patterns such as $C_3 \Rightarrow C_4 \Rightarrow C_5$ in $C_1 \Rightarrow C_2 \Rightarrow C_3 \Rightarrow C_4 \Rightarrow C_5 \Rightarrow C_3 \Rightarrow C_4 \Rightarrow C_5$ ….

Next we proceed onto describe the fuzzy tool Fuzzy Relational Equations (FRE).

Fuzzy relation equations can be interpreted as the usual algebraic equations where the coefficients of these equations are fuzzy constraints that is they are values varying between [0, 1]

which will be interpreted as membership grades. As in the case of solving algebraic equations here also we use only matrices with max-min principles to solve the fuzzy relation equations.

A fuzzy set μ is a map from X to [0, 1] i.e., $\mu : X \to [0, 1]$ such that if $x \in X$, $\mu(x) \in [0, 1]$, $\mu(x)$ is called the membership grade of x in X.

The notion of fuzzy relation equation is associated with the concept of composition of binary relations. Consider three binary relations P(X, Y), Q(Y, Z) and R(X, Z), which are defined on the sets

$$X = \{x_i / i \in I\}, Y = \{y_i / j \in J\} \text{ and } Z = \{z_k / k \in K\},$$

where we assume that $I = N_n$, $J = N_m$, and $K = N_s$.

Let the membership matrices of P, Q and R be denoted by $P = [P_{ij}]$. $Q = [q_{jk}]$ and $R = [r_{ik}]$ respectively where $p_{ij} = P(x_i, y_i)$, $q_{jk} = Q(y_j, z_k)$ and $r_{ik} = R(x_i, z_k)$ for all $i \in I$ $(= N_n)$, $j \in J$ $(=N_m)$ and $k \in K$ $(=N_s)$.

This means that all entries in the matrices P, Q and R are real numbers in the unit interval [0, 1]. Assume now that the three relations constrain each other in such a way that

$$P \text{ o } Q = R \qquad (2.1)$$

where 'o' denotes the max-min composition. This means that

$$\max_{j \in J} \min (p_{ij}, q_{jk}) = r_{ij} \ \forall i \in I \text{ and } k \in K \qquad (2.2)$$

That is the matrix equation (P o Q = R) encompasses $n \times s$ simultaneous equation of the form (2.2). When two of the components in each of the equations are given and one is unknown, these equations are referred to as fuzzy relation equations. When matrices P and Q are given and matrix R is to be determined from (2.1), the problem is trivial. It is solved simply by performing the max-min multiplication like operation

on P and Q as defined by (2.2). Clearly the solution in this case exists and is unique. The problem becomes far from trivial when one of the two matrices on the left hand side of (2.1) is unknown. In this case, the solution is not guaranteed, neither to exist nor to be unique.

When the solution does not exist we, to obtain a solution by adopting the theory of neural networks. A brief description of neural networks is as follows:

At the first stage we try to represent fuzzy relational equations by neural networks. Our discussion is restricted to the form P o Q = R where 'o' is the max-product composition.

Let $P = [p_{ij}]$, $Q = [q_{jk}]$ and $R = [r_{ik}]$, where $i \in N_n$, $j \in N_m$ and $k \in N_s$. We assume that relations Q and R are given, and we want to determine P. Equation P o Q = R represents the set of equations

$$\max_{j \in N_m} p_{ij}, q_{jk} = r_{ij} \quad \text{for all } i \in N_n, \ k \in N_s \tag{2.3}$$

To solve (2.3) for p_{ij} ($i \in N_n$, $j \in N_m$), we can use a feed forward neural network with m inputs and only layer with n neurons. Here the linear activation function f for all $a \in R$ is defined by

$$f(a) = \begin{cases} 0 & \text{if } a < 0 \\ a & \text{if } a \in [0,1] \\ 1 & \text{if } a > 1 \end{cases}$$

and the output y_i of neuron i is defined by $y_i = f\left(\max_{j \in N_m} W_{ij}\, x_j\right)$ ($i \in N_n$). (W_{ij} are weights for more about these concepts please refer [2]).

Given P o Q = R, the training set consists of columns q_{jk} of matrix Q as inputs

($x_j = q_{jk}$ for each $j \in N_m$, $k \in N_s$) and columns r_k of matrix R as expected outputs ($y_i = r_{ik}$ for each $i \in N_n$, $k \in N_s$). When P o Q = R has no solution, the error function does not reach zero. In this case, any set of weights for which the error function reaches its minimum is not necessarily an approximate solution of P o Q = R.

Next we proceed on to describe the notion of Bidirectional Associative Memories (BAM) model.

Fuzzy systems can estimate functions and control systems with partial description of the system behaviour. Neural and fuzzy systems share the same state space and can estimate input-output functions. They are trainable dynamical systems.

A group of neurons forms a field. Neural networks contain many fields of neurons.

Suppose F_x - denotes a neuron field which contains n-neurons and F_Y-denotes a neuron field which contains p-neurons.

The neuronal dynamical system is described by a system of first order differential equations that govern the time evolution of the neuronal activation.

$$\dot{x}_i = g_i (X, Y, \ldots)$$

$$\dot{y}_j = h_j (X, Y, \ldots)$$

where $\dot{x}_i$ and $\dot{y}_j$ denote, respectively, the activation time function of the ith neuron in F_x and the jth neuron in F_Y. The over dot denotes time differentiation, g_i and h_j are some functions of X, Y etc.; where

$$X(t) = (x_i(t), \ldots, x_n(t))$$

$$Y(t) = (y_1(t), \ldots, y_p(t))$$

define the state of the neuronal dynamical system at time t.

Let us support that the field F_x with n-neurons is synaptically connected to the field F_Y with p-neurons. Let m_{ij} be a synapse (junction) from the i^{th} neuron in F_x and the j^{th} neuron in F_Y, m_{ij} can be positive, negative or zero ($1 \leq i \leq n$ and $1 \leq j \leq p$).

The synaptic matrix M is a $n \times p$ matrix of real numbers whose entries are synaptic efficacies m_{ij}. The matrix M or the network describes the forward projection from the neuronal field F_x to the neuronal field F_Y. Similarly, a $p \times n$ synaptic matrix N or the network describes the backward projection from F_Y to F_x.

The network is said to be bi-directional network if $M = N^T$ and $N = M^T$. When the activation dynamics of the neuronal fields F_x and F_Y lead to the overall stable behaviour, the bi-directional networks are called as Bidirectional Associative Memories or BAM.

An additive model is defined by a system of n + p coupled first-order differential equations that interconnects the fields F_x and F_Y through the constant synaptic matrices M and N described earlier;

$$\dot{x}_i = -A_i x_i + \sum_{j=1}^{p} S_j(y_j) n_{ji} + I_i$$

$$\dot{y}_i = -A_j y_j + \sum_{i=1}^{n} S_i(x_i) m_{ij} + J_j$$

$S_i(x_i)$ and $S_j(y_j)$ denote, respectively, the signal function of the i^{th} neuron in the field F_x and the signal function of the j^{th} neuron in the field F_Y. Discrete additive activation models correspond to neuron with threshold signal functions. The neurons can assume only two values, ON and OFF, where ON

represents the signal value +1 and OFF represents 0 or –1 (–1 when the representations is bipolar).

Additive bivalent models describe asynchronous and stochastic behaviour. At each moment, each neuron can randomly decide whether to change state, or whether to emit a new signal given its current activation.

The BAM is a non-adaptive additive bivalent neural network.

In real life problem the entries of the constant synaptic matrix M depends upon the experts opinion or the investigator's feelings. The synaptic matrix is given a weightage according to the experts opinion or their feelings. If $x \in F_x$ and $y \in F_Y$, the forward projection from F_x to F_Y is defined by the matrix M.

$\{F(x_i, y_i)\} = (m_{ij}) = M, 1 \le i \le n, 1 \le j \le p.$

The backward projections are defined by the matrix M^T.

$\{F(y_j, x_i)\} = (m_{ji}) = M^T, 1 \le i \le n, 1 \le j \le p.$

All BAM state change lead to fixed-point stability. The property holds for synchronous as well asynchronous state changes.

A BAM system (F_x, F_Y, M) is bi-directionally stable if all inputs coverage to fixed-point equilibria. The bi-directional stability is a dynamic equilibrium. The same signal information flows back and forth in a bi-directional fixed point.

Let us suppose that A denotes a binary n-vector and B denotes a binary p-vector. Let A be the initial input to the BAM system.

Then the BAM equilibrates to a bi-directional fixed point (A_f, B_f) as

$$\begin{aligned}
&A \to M \to B\\
&A' \leftarrow M^T \leftarrow B\\
&A'' \to M \to B'\\
&A'' \leftarrow M^T \leftarrow B'\\
&\vdots\\
&A_f \to M \to B_f\\
&A_f \leftarrow M^T \leftarrow B_f
\end{aligned}$$

where A', A'' … and B', B'', … represent intermediate or transient signal state vectors between A, A_f and B, B_f respectively.

The fixed point of a bi-directional system is time dependent. The fixed point for the initial input vectors can be attained at different times. Based on the synaptic matrix M which is developed by the expert's opinion or the investigator's feelings, the time at which bi-directional stability is attained also varies accordingly. For more about BAM model refer [1].

Now we proceed onto describe the notion of Fuzzy Associative Memories (FAM) and their properties.

The Unit hypercube $I^n = [0, 1]^n = [0, 1] \times \ldots \times [0, 1]$ product of [0, 1] taken n-times consists of the set of all vectors of length n and the coordinates are taken from the unit interval [0, 1].

In general fuzzy set μ are maps from a universal set X to the unit interval [0, 1];

$$\text{i.e., } \mu : X \to [0, 1].$$

Throughout this book while describing FAM by a fuzzy set we mean a point in the unit hypercube. Thus in this book while working with FAM we do not take the usual fuzzy sets i.e., a map μ from a universal set X to the unit interval [0, 1].

Fuzzy system define mappings between cubes. Fuzzy system S maps fuzzy sets to fuzzy sets. Thus the fuzzy system

S is a transformation i.e., $S : I^n \to I^p$ where n and p are finite positive integers. The n-dimensional unit hypercube I^n consists of all the fuzzy subsets of the domain space $X = \{x_1, \ldots, x_n\}$; $x_i \in R$, $i = 1, \ldots, n$. Similarly I^p consists of all the fuzzy subsets of the range space $Y = \{y_1, \ldots, y_p\}$; $y_i \in R$, $i = 1, \ldots, p$. Hence X denotes a subset of R^n and Y denotes a subset of R^p.

The function f maps n-vectors in X to p-vectors in Y. The continuous function f maps small changes in input to small changes in output i.e., if the input patterns are close to one another then the output patterns are close to one another. The system maps similar inputs to similar outputs.

Fuzzy system $S : I^n \to I^p$ maps balls of fuzzy sets in I^n to balls of fuzzy sets in I^p. These continuous fuzzy system behaves as an associative memory known as fuzzy associative memory.

Let A and B be the fuzzy subsets of X and Y respectively where $X = \{x_1, \ldots, x_n\}$ and $Y = \{y_1, \ldots, y_p\}$. A defines a point in the n-dimensional unit hypercube I^n and B defines a point in the p-dimensional unit hypercube I^p. Equivalently A and B define the membership functions m_A and m_B respectively, that map the elements x_i of X and y_j of Y to [0, 1].

The membership values will be known as fit values which indicates how much x_i belongs to or fits in the subset A and how much y_j belongs to or fits in the subset B. Therefore we say that $\{x_1, \ldots, x_n\}$ is the fit vector that represents A and $\{y_1, \ldots, y_p\}$ is the fit vector that represents B.

We describe this with the abstract functions.

$$m_A : X \to [0, 1]$$

$$m_B : Y \to [0, 1].$$

Since here the fuzzy sets A and B are points in unit hypercube, one can view A and B as natural vectors. Represent A and B by numerical fit vectors (if the fit values are given

numerical values then the fit vector is known as numerical fit vector).

$A = \{a_1, \ldots, a_n\}$ and $B = \{b_1, \ldots, b_p\}$, where $a_i = m_A(x_i)$ and $b_j = m_B(y_j)$.

The fuzzy set association (A_i, B_i) is named as a "rule". The antecedent term A_i in the fuzzy set association (A_i, B_i) is known as input associant and the consequent term B_i is known as output associant.

The FAM system maps points A_j near A_i to points B_j near B_i. The closer A_j is to A_i, the closer the point (A_j, B_j) is to point (A_i, B_i) in the product space $I^n \times I^p$. In this sense FAMs map balls in I^n to balls in I^p. That is only FAM can give results which are graded or it not only gives the solutions but the gradation of importance of each solution.

We now proceed onto briefly describe the Fuzzy Relational Maps (FRMs) model.

The new notion called Fuzzy Relational Maps (FRMs) was introduced by Dr. W.B. Vasantha and Yasmin Sultana in the year 2000. In FRMs we divide the very casual associations into two disjoint units, like for example the relation between a teacher and a student or relation between an employee and an employer or a relation between the parent and the child in the case of school dropouts and so on. In these situations we see that we can bring out the causal relations existing between an employee and employer or parent and child and so on. Thus for us to define a FRM we need a domain space and a range space which are disjoint in the sense of concepts. We further assume no intermediate relations exists within the domain space and the range space. The number of elements in the range space need not in general be equal to the number of elements in the domain space.

In our discussion the elements of the domain space are taken from the real vector space of dimension n and that of the

range space are real vectors from the vector space of dimension m (m in general need not be equal to n). We denote by R the set of nodes R_1, …, R_m of the range space, where $R_i = \{(x_1, x_2, \ldots, x_m) / x_i = 0 \text{ or } 1\}$ for i = 1, …, m. If $x_i = 1$ it means that the node R_i is in the ON state and if $x_i = 0$ it means that the node R_i is in the OFF state.

Similarly D denotes the nodes D_1, …, D_n of the domain space where $D_i = \{(x_1, \ldots, x_n) / x_j = 0 \text{ or } 1\}$ for j = 1, …, n. If $x_i = 1$, it means that the node D_i is in the ON state and if $x_i = 0$ it means that the node D_i is in the OFF state.

A FRM is a directed graph or a map from D to R with concepts like policies or events etc. as nodes and causalities as edges. It represents casual relations between spaces D and R. Let D_i and R_j denote the two nodes of an FRM. The directed edge from D to R denotes the causality of D on R, called relations. Every edge in the FRM is weighted with a number in the set {0, 1}.

Let e_{ij} be the weight of the edge $D_i R_j$, $e_{ij} \in \{0, 1\}$. The weight of the edge D_iR_j is positive if increase in D_i implies increase in R_j or decrease in D_i implies decrease in R_j. i.e., causality of D_i or R_j is 1. If $e_{ij} = 0$ then D_i does not have any effect on R_j. We do not discuss the cases when increase in D_i implies decrease in R_j or decrease in D_i implies increase in R_j.

When the nodes of the FRM are fuzzy sets, then they are called fuzzy nodes, FRMs with edge weights {0, 1} are called simple FRMs.

Let D_1, …, D_n be the nodes of the domain space D of an FRM and R_1, …, R_m be the nodes of the range space R of an FRM.

Let the matrix E be defined as $E = (e_{ij})$ where $e_{ij} \in \{0, 1\}$; is the weight of the directed edge $D_i R_j$ (or $R_j D_i$), E is called the relational matrix of the FRM or the dynamical system associated with the FRM.

It is pertinent to mention here that unlike the FCMs, the FRMs can be a rectangular matrix; with rows corresponding to the domain space and columns corresponding to the range space. This is one of the marked difference between FRMs and FCMs.

Let $D_1, \ldots, D_n$ and $R_1, \ldots, R_m$ be the nodes of an FRM. Let D_iR_j (or $R_j D_i$) be the edges of an FRM, $j = 1, \ldots, m$, $i = 1, \ldots, n$. The edges form a directed cycle if it possesses a directed cycle. An FRM is said to be an acycle if it does not posses any directed cycle.

An FRM with cycles is said to have a feed back when there is a feed back in the FRM, i.e., when the causal relations flow through a cycle in a revolutionary manner the FRM is called a dynamical system.

Let $D_i R_j$ (or $R_j D_i$); $1 \leq j \leq m$, $1 \leq i \leq n$. When R_i (or D_j) is switched ON and if causality flows through edges of the cycle and if it again causes R_i (or D_j), we say the dynamical system goes round and round. This is true for any node R_i (or D_j) for $1 \leq i \leq m$, (or $1 \leq j \leq n$).

The equilibrium state of this dynamical system is called the hidden pattern. If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point.

Consider an FRM with $R_1, \ldots, R_m$ and $D_1, \ldots, D_n$, as nodes. For example let us start the dynamical system by switching on R_1 or D_1. Let us assume the FRM settles down with R_1 and R_m (or D_1 and D_n) on i.e., the state vector remains as (1 0 … 0 1) in R (or (1 0 … 0 1) in D), this state vector is called the fixed point.

If the FRM settles down with a state vector repeating in the form $A_1 \to A_2 \ldots A_i \to A_1$ (or $B_1 \to B_2 \ldots B_i \to B_1$) then this equilibrium is called a limit cycle.

We give the method of determining the hidden pattern.

Let $R_1, \ldots, R_m$ and $D_1, \ldots, D_n$ be the nodes of a FRM with feed back. Let E be the $n \times m$ relational matrix. Let us find a hidden pattern when D_1 is switched on, i.e., when an input is given as vector $A_1 = (1\ 0\ 0\ \ldots\ 0)$ in D the data should pass through the relational matrix E.

This is done by multiplying A_1 with the relational matrix E. Let $A_1E = (r_1, \ldots, r_m)$ after thresholding and updating the resulting vector (say B) belongs to R. Now we pass on B into E^T to obtain BE^T. After thresholding and updating BE^T we see the resultant vector say A_2 belongs to D. This procedure is repeated till we get a limit cycle or a fixed point, which is the hidden pattern of A_1 for the dynamical system E.

Chapter Three

CAUSES OF SCHOOL DROPOUTS – A MATHEMATICAL ANALYSIS

In this chapter we study the causes for children to discontinue their studies using the collected data from about 700 school dropouts from Chennai city, rural areas of Tamil Nadu and from other cities in Tami Nadu.

The data collection was mainly through discussions. If we wanted to know about school dropouts we met also the persons whose children were studying and collected the dropouts in their class. For the question was not only delicate for several parents when their child is a school dropout did not wish to give the complete details of him/her for it may be fear due to social stigma if their ward was a rowdy or a miscreant in that area or may be he is a runaway and not living with them. So as far as possible; we played the game of collection of data in a very safe way to ensure that the data was true and authenticated.

Most children in the age 9 to 14 years spoke very openly about their elder siblings and also about their classmates. The collection of data was done in the school play grounds or near by places of the school so that we got proper information. Further collecting data from rich and upper middle class

happened to be close to an impossibility. We observed that in case of rich and very rich the very question of school dropout does not arise. For if he/she fails in a class she/he is shifted to another school. Private coaching and all possible special attention is given so in case of rich and very rich it is never a dropout but change of schools to some how make their child get the pass certificate in X and XII classes. The authors by no means wish to state this in support of poor or very poor or praise the rich/very rich.

Our discussions and continued interviews with the students from rich schools also revealed only this information. We say a school to be a "rich school" when the fees is very high and only very rich or rich students or influential people's children study in that school.

The study of school drop out in the context of rich or very rich in India does not arise this was confirmed by several methods through discussions and interviews.

Next comes the study of school dropout in upper middle class, middle class and lower middle class. In upper middle class school dropouts may occur as in case of rich they will try to give an alternative course of study or put them in other schools using influence. Here we make it clear that in case of rich, very rich and upper middle class if a school drop out occurs they may be also run away from home, which will never come out in public or will be acknowledged by them to authors, but can be only verified by indirect means.

We now study the school drop outs from middle class, lower middle class, poor and very poor. In all the four cases we see they may stay in their home if they are school dropouts from rural or be runaways. If they take up the job or the work or share the burden of their father they may prosper and educate the other siblings of the family this occurs in rural case provided the parents are also illiterates; and the family has no problems and the problem is only with the school. We have several such instances. In case father is a literate and is teacher or a post

master or holds some clerical post in government or in private sector the dropout son invariably becomes a miscreant in that locality if he stays in his home. If he is a runaway the problem is entirely different; he may join the bad company and finally land in jail or be in juvenile home or in the police custody. To be true to ones mathematical analysis which is relied upon the data collected from people from different walks of life we saw out of the about 700 people only the paltry percentage of 10% who have been sent to child welfare homes have completed their 10^{th} standard and some 12^{th} standard a few now in colleges. Almost all the runaway school dropouts who sought self employed profession like rag picking or begging have only landed in a very pathetic situation some being the victims of inducted in falsely knitted crimes and those who continued in that profession suffer a serious health hazards like skin ailments, constant seasonal fever like Malaria, typhoid, and frequently ill and suffering with some disease or the other; hence poverty has taken over them. Their homes are near dustbins, bus stands or railway stations left to the mercy of mosquitoes and bad weather conditions.

We have been working with this problem over a decade. Some of the rag pickers whom we had met some five or seven years ago are no more or in jail for the crime they have not done or missing, no news about their whereabouts. On the whole the data showed the horrid story of their lives after they ran away from their homes. Only less than 2% would have been in a position to pull on with some stamina.

It is in a way fortunate to know those who took to begging in the city after they left their homes where rehabilitated in child welfare homes and several of them studied atleast upto 10^{th} or 12^{th} standard.

However those school dropouts who joined gangs of miscreants and antisocial elements and stayed in platforms begging in trains invariably had a very problematic life for they were prayed and misused by culprits and suffered at a very young age; mental trauma of life and physical problems like

skin ailments, STD and so on. The gang lived in by doing petty thefts and so on. They had to evade the police and keep an eye all the time to escape the police and other probable miscreants who gave them constant trouble (sexually abused and so on).

The other side of the school dropouts being employed in hotels, household or construction labourers and so on had a good turn of if they were saved as child labourers other wise they lost their life in the same job.

Now we first in this chapter study the causes of school drop outs using FCM, modified FCM and FREs.

We take a non-simple FCM in which the entries are taken from the interval [–1, 1]. Now instead of using the usual operation on FCM described in chapter II, we use the max-min operation and arrive at the hidden pattern.

We face the following possibilities:

We do get the stability of the system and the stability attained as a fixed point or the stability attained as a limit cycle.

We call this FCM model as the Modified FCM. The chief merit of this model is that it gives the gradations of the attributes which is new only with this modified model.

We describe the problem.

Interview was taken from over 700 families in Tamil Nadu. We studied separately the issues of school dropouts in rural Tamil Nadu and also school dropouts in city and in slums in the city and also dropouts in rich, poor and middle class.

We list out briefly the main attributes and label them as C_1, C_2, …, C_{12} mainly related to school dropouts from lower middle class and poor both from the cities in Tamil Nadu and rural areas.

C_1 : Poverty and the inability of their parents to meet the educational expenses.

C_2 : The need and pressure on the child to look after the younger siblings or cattle or other house hold work.

C_3 : The longing of the child to help out in the family trade / family income.

C_4 : Frustration as no one to help in home work / studies (punished for not doing homework so on).

C_5 : Categorization of good / average / poor student in the school system.

C_6 : Child's utter lack of interest in studies as studies does not appeal to him / her.

C_7 : Irritation / anger or fear on the teachers / authorities as the child feels ill-treated by them.

C_8 : Gender discrimination and closed attitude forces the female child to be a drop out.

C_9 : Momentary feeling of security / comfort in the bad company of spoilt children.

C_{10} : Irritating atmosphere at home which is not conducive for study and development.

C_{11} : Unable to cope up with the rigid, routine activities and discipline at school.

C_{12} : Attraction of the outside 'free' world other than the disciplined school atmosphere.

For our calculation purpose, we choose a few of the above attributes and apply FCM and MFCM models.

We use the following attribute and construct the FCM model. At the outset we are justified in using this model

(i) for the attributes are inter related

(ii) the data is an unsupervised one and involves a lot of feeling on the part of the school dropouts. Finally this model gives the hidden pattern of the problem.

The first expert who is a social scientist has picked up the following attributes which are listed below.

C_1 : Poverty and the pain caused by the knowledge of parent's inability to pay fees.

C_2 : Frustration as no one to help in home work / studies (punished by teachers for not doing home work).

C_3 : Categorization of very good / good / average / poor / very poor - student.

C_4 : Irritation / anger on the teacher's / authorities as the child feels ill-treated.

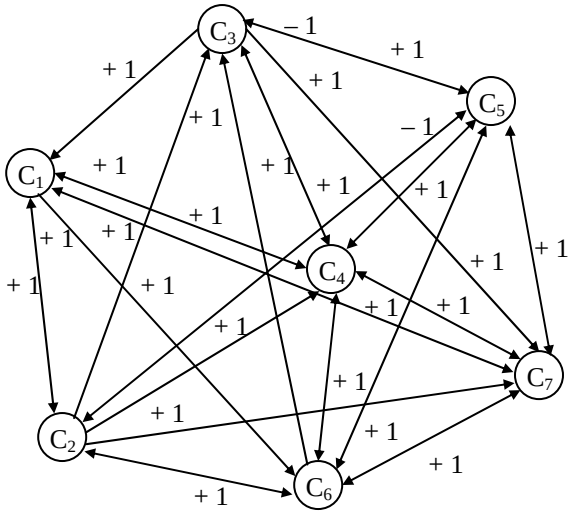
C_5 : Child's boredom in studies as school and studies do not appeal to them (school / classroom looks more like a prison).

C_6 : Uneasiness to cope up with the rigid, routine activities and discipline at school.

C_7 : Momentary feeling of security / comfort in the company of 'spoilt children'.

As the data is an unsupervised one, the attributes are inter related and involves lot of uncertainties we are justified in using FCM to analyze the problem.

The directed graph given by the socio scientist using the nodes $C_1, C_2, \ldots, C_7$ is as follows:



Using the above directed graph we obtain the connection matrix M_1 which forms the dynamical system of the FCM.

$$\begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \\ C_7 \end{array} \begin{array}{c} \begin{array}{ccccccc} C_1 & C_2 & C_3 & C_4 & C_5 & C_6 & C_7 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & -1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & -1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array} = M_1.$$

Let us suppose that we use a constant k, say k = 3 here, while thresholding.

Let the initial state vector say C_1, C_5 and C_7 be in the on ON state i.e., X = (1 0 0 0 1 0 1).

The symbol $\hookrightarrow$ stands for thresholding and it means that negative values and all other values less than 3 are replaced by zeros, values greater than or equal to three (for k = 3) are

replaced by 1. The component which had been kept in ON state initially will always be retained in ON state which is the concept of updating the resultant state vector. The effect of X on the dynamical system M_1 gives;

X_1M_1 = (1 2 –1 3 1 3 2) ↪ (1 0 0 1 1 1 1) = X_2

$X_2 M_1$ = (2 3 1 4 3 4 4) ↪ (1 1 0 1 1 1 1) = X_3

$X_3 M_1$ = (2 3 2 5 3 5 5) ↪ (1 1 0 1 1 1 1) = X_4 (= X_3).

Therefore, the hidden pattern of X is the fixed point. Except the attribute relating to categorization or grouping in school all other attributes get to ON state. Thus we analyze and interpret the conclusion as follows:

That is when C_1 (Poverty), C_5 (boredom in school) and C_7 (comfort in the company of spoiled children) are kept in the ON state, it makes all the attributes except C_3 to come to ON state thus perpetuating poverty, increasing frustration on the child as there is no one to help in home work / studies. Thus the irritation / anger on the teacher's / authorities increases many fold and hence the child looses interest in education. As the child is agitated with the rigid, routine activities and discipline at school and finds a momentary feeling of security / comfort in the bad company of spoilt children, the child 'makes up its mind' to leave the school for ever.

For the initial state vector, keep C_2, C_4 and C_6 in the ON state. i.e., Y_1 = (0 1 0 1 0 1 0). The effect of Y_1 on the dynamical system M_1 gives

$Y_1 M_1$ = (1 1 3 3 1 2 3) ↪ (0 1 1 1 0 1 1) = Y_2 (say)

$Y_2 M_1$ = (3 1 3 4 3 3 4) ↪ (1 1 1 1 1 1 1) = Y_3 (say)

$Y_3 M_1$ = (3 3 2 6 3 5 6) ↪ (1 1 0 1 1 1 1) = Y_4 (say)

$Y_4 M_1$ = (2 3 2 5 2 5 5) ↪ (0 1 0 1 0 1 1) = Y_5 (say)

$Y_5 M_1$ = (2 1 3 3 2 3 3) ↪ (0 1 1 1 0 1 1) = Y_2 (say)

$Y_2 M_1$ = (2 3 1 4 3 4 4) ↪ (1 1 0 1 1 1 1) = Y_4 (say)

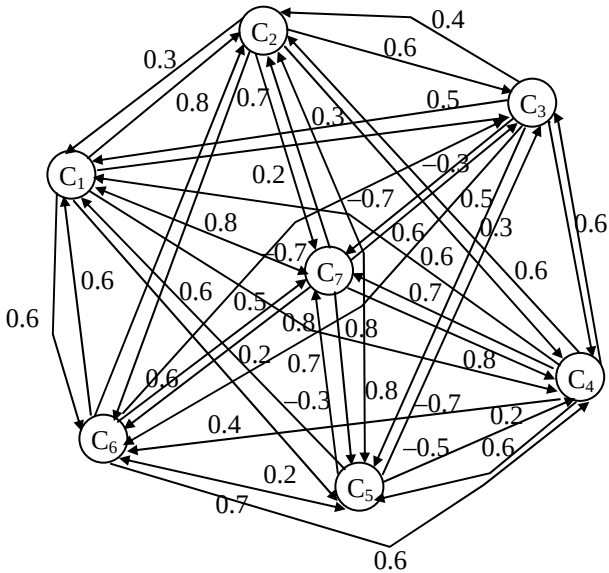
$Y_3 M_1 = (3\ 3\ 2\ 6\ 3\ 5\ 6) \hookrightarrow (0\ 1\ 0\ 1\ 0\ 1\ 1) = Y_5$.

Clearly the hidden pattern is a limit cycle given by

$Y_2 \Rightarrow Y_3 \Rightarrow Y_4 \Rightarrow Y_5 \Rightarrow Y_2 \Rightarrow Y_4 \Rightarrow Y_5$.

By the FCM method, we notice that all the above said attributes form a clear case for the increase in the rate of school dropouts and they have a strong inter relationship with each other and one causes the other. Emotional disturbance in a student leads to lack of interest and that ends up in poor performance. Once the child is admonished for its poor performance, ill feelings and hatred builds up against the school, its rules and regulations, teachers, authorities, books, notes and all work related to school and studies. Finally the child ends up on the street with the company of bad and spoilt elements who make their future still worse. However the limit cycle as the hidden pattern shows easily these children can be brought back to regular life by proper motivation and by giving counciling and affection.

For the same seven attributes the same expert was asked to give values and the following simple connection matrix was obtained from the weighted fuzzy graph which is as follows:



The connection matrix M_2 associated with the weighted directed graph is as follows:

$$M_2 = \begin{bmatrix} 0 & 0.8 & 0.3 & 0.6 & 0.2 & 0.6 & 0.8 \\ 0.3 & 0 & 0.6 & 0.6 & -0.7 & 0.6 & 0.7 \\ 0.5 & 0.4 & 0 & 0.7 & 0.8 & 0.2 & 0.6 \\ 0.7 & 0.3 & 0.6 & 0 & 0.6 & 0.4 & 0.8 \\ -0.3 & 0.8 & -0.5 & 0.2 & 0 & 0.7 & 0.7 \\ 0.6 & 0.8 & 0.7 & 0.6 & 0.7 & 0 & 0.8 \\ 0.8 & 0.2 & -0.3 & 0.7 & 0.7 & 0.5 & 0 \end{bmatrix}.$$

The expert chooses a fit vector $A_1 = (1\ 1\ 0\ 0\ 0\ 0\ 1)$ stating that poverty or inability to pay the exorbitant school fee on various headings, no one at home to help in studies or parents inability to send for a tuition in the evening and the bad company of the child in playing with others or watching movies than concentrating on studies.

We apply max-min principle to find the effect of the state vector A_1 on the dynamical system M_2.

$$\max \min \{A_1, M_2\} = (0.8\ \ 0.8\ \ 0.6\ \ 0.7\ \ 0.7\ \ 0.6\ \ 0.8) = A_2.$$

Now we find

$$\max \min \{A_2, M_2\} = (0.8\ \ 0.8\ \ 0.6\ \ 0.7\ \ 0.7\ \ 0.7\ \ 0.8) = A_3$$
$$\max \min \{A_3, M_2\} = (0.8\ \ 0.8\ \ 0.7\ \ 0.7\ \ 0.7\ \ 0.7\ \ 0.8) = A_4$$
$$\max \min \{A_4, M_2\} = (0.8\ \ 0.8\ \ 0.7\ \ 0.7\ \ 0.7\ \ 0.7\ \ 0.8) = A_4.$$

A_4 is the fixed vector and as in the case of FCM, the hidden pattern of the MFCM also reveals the same kind of result leading all the attributes to high value near 1 and the attributes cited by the expert obtaining the maximum score of 0.8. All the other attributes get 0.7 thus forming a group.

For same matrix M_2, the expert has given another state vector, viz. $B_1 = (0\ 0\ 1\ 1\ 1\ 0\ 0)$ which states that the

categorization in schools as good / average / poor leads to discouragement and dissatisfaction with the school system of comparison and ranking, when scolded or admonished by the teacher and authorities in the school in the presence of other students leads to irritation on the school system which does not find any out let or has no appraisal system to voice out the grievance and lack of interest in studies as it does not excite any kind of curiosity or interest in the student. He feels freedom is lost.

max min $\{B_1, M_2\} = (0.7\ 0.8\ 0.6\ 0.7\ 0.8\ 0.7\ 0.8) = B_2$;
max min $\{B_2, M_2\} = (0.8\ 0.8\ 0.7\ 0.7\ 0.7\ 0.7\ 0.7) = B_3$
max min $\{B_3, M_2\} = (0.7\ 0.8\ 0.7\ 0.7\ 0.7\ 0.7\ 0.8) = B_4$
max min $\{B_4, M_2\} = (0.8\ 0.8\ 0.7\ 0.7\ 0.7\ 0.7\ 0.8) = B_4$.

The hidden pattern of $B_1 = (0\ 0\ 1\ 1\ 1\ 0\ 0)$ is a fixed vector B_4.

B_4 is the fixed vector which give high values to all the attributes and highlighting the aspect that if there is no one at home to help the children in their studies, naturally they get into games and playing with children who are already a spoiled lot. Thus in turn all other attributes also get highlighted in this MFCMs.

We compare the results from FCMs and MFCMs.

At the outset, FCMs and MFCMs may look as if they yield the same result but actually the MFCM gives a refined result by differentiating the values between the attributes. We can find the inner relationship between the attributes by grouping them according to the values they get like lack of attention at home helping in their studies and strong binding of the children with the bad company of children. The rest of the attributes form another group.

The FCM gives just ON and OFF states of for the attributes where as MFCM result yields the gradation of the attributes. Another important feature of MFCM is that no bias is made by thresholding the resultant vector at each stage.

If remedial measures are taken at the earliest, at each level, we can reduce the rate of school dropouts.

1. Students should be made to feel happy and satisfied at the school environment with their performance and with the input given in schools. School should become their second home and a place where they 'feel at home'. Encouragement, appreciation, boosting up the morale, challenge to do better must be the key words in schools rather than imposition, fines and punishment.

2. Discrimination in school should be avoided. When the government and school authorities insist on uniform to make the children feel not differentiated, they should see to that the children are not discouraged and humiliated by the system of categorization they follow in schools.

3. There should be more of encouragement and scope for counseling the students when they are noticed in sad moods. It is said that children walk to school in the morning and run back home in the evening. The environment in school must be changed to change the above state.

4. Government must take steps to reduce the cost of education and bring it back to the 'Service List' than the 'Sales List'. Students should be motivated to take both pleasant and unpleasant moments in school as it is a place for learning and correction and there is nothing wrong in committing a mistake provided he / she learns from their mistakes.

5. Activities in school must be aimed at the over all growth of the child and not just the memory aspect alone. There must be enough awards, incentives for the so called non-educational aspect of ones growth where creativity, spontaneity, and companionship are revealed. Government should give 'State First Award' not just to the student who scores high marks in Tenth or Plus Two final exams but who has excelled in all other aspects of ones own growth.

6. Parents must take to protect their children from unhealthy media, gadgets and friendship. Enough activities, responsible errands and encouraging presence of parents and elders must be there at home.

7. Finally students must be taught the values of life and virtues like patience, tolerance, forgiving others helping others in need understanding the problem and facing it and not succumbing to the problems.

The majority of the school dropouts from rural and urban areas, land as child labourers due to poverty or at times to divert the child from becoming a victim of bad company and there by becoming an anti social element. Thus the concept of child labourer and school drop out go hand in hand. These two notions are inseparable and in fact one accelerates the other. So when we study the dropouts we also are faced with the problem of child labourers. The child labourers are of two types: one forced by others and the other opted by them. The school dropouts are involuntarily forced to become child labourers due to child trafficking, which thrives with parents support [7]. But government on the other hand must pass Bills on compulsory free education for poor and first generation learners from rural areas and slums [8]. It is reported from New York, that there are one crore children who are child labourers going through all sorts of sufferings.

It is reported in The Indian Express that several organizations rescue the child labourers, but in spite of it we see that till date the number of school dropouts is on the increase and the number of children getting into some form of labour either forced or voluntarily is also on the increase.

We have interviewed over 700 persons from all walks of life from villages, rural areas, slum and cities in Tamil Nadu. The attributes or qualities related with them are all very uncertain, varying from student to student; place to place and also varying with the socio economic conditions. As we see the

problem involves lots of uncertainties and qualities very interdependent on parents, teachers and public.

Now we proceed onto study and analyse the causes of school dropouts using Fuzzy Relational Equations (FRE).

Here the experts study the problem using FRE model. Adaptation of the problem of school dropouts associated with parents, private and government schools to the fuzzy relational equations model is done by taking as the attributes S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8 that relate to schools run by both government and private parties. The attributes C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9, C_{10} that relate to school children dropping out of schools are briefly described.

Attributes relating to the educational institutions.

S_1 - Private schools charge a very high fee, huge donations and entrance exams.

S_2 - Private schools do not admit students whose parental income is low or educational qualification is low.

S_3 - Private schools develop a culture and caste among its students and in that atmosphere a poor student finds himself or herself out of place.

S_4 - Private schools promote more of English than the vernacular so a problem in free communication is faced by majority of the rural students and first generation learners.

S_5 - Government schools give utter disregard to infra structure and class room facilities, library, play ground and laboratory.

S_6 - In Government schools there are not adequate number of qualified teachers. Even those who are in the schools concentrate on private tuitions and above all some side

business as often found in the case of private school teachers and in the case of government school teachers the school teaching is considered to be a part time job while they concentrate on other earnings of LIC agent, chit, finance and money leading and some kind of business like stationery shop, Xerox shop and STD booth, in the towns and cities.

S_7 - Often government schools lag behind in good teaching and discipline and thus it has more school dropouts. Proportion to teacher student ratio is very high. Further teachers get their private work from the school children during school hours.

S_8 - Both in Government and Private schools there are not many teachers who could encourage and motivate the students to do their best in every field for the reasons best known to them.

Attributes or causes relating to children who dropout of schools.

C_1 - Parents are poor and are not in a position to pay huge amount as fees.

C_2 - Parents are not educated to help their own children at home to complete the homework or to revise daily class work (students are punished if they do not do the home work).

C_3 - Parents are not motivated and do not understand the importance of education.

C_4 - Children get into bad company and become dropouts when they face problems of communication and form gangs and take up to bad habits.

C_5 - Children have to go for any available errands or daily or part time work to make up the family expenses.

C_6 - Children's step parents force them to work in cycle shops, provision stores, etc.

C_7 - Poor children are discouraged very much by teachers and sometimes even ridiculed in front of others, often for no fault of their own (which forces them to shun school).

C_8 - Children have to walk a long distance to reach school as there is neither a good road facilities not the buses are available to suit the school timings so they drop out from study (No safety for girls so they do not send them to school).

C_9 - Due to gender difference, female children are stopped from school after a stage and made to work for parents at home as baby sitters or take care of the kitchen.

C_{10} - Government keeps a indifferent attitude towards children's issues as they are not their vote banks (for the politicians). Even the least of punishment is given to the persons who practice child labour or schools, which promote dropouts.

Even though we can mention many more attributes, we select a few for our analysis given by the experts. We choose a few attributes and fix the following as the limits sets using the discussions and interviews with people related to school dropouts and including school dropouts.

$S_1 \geq 0.5$ means the school fee is too high to pay for a parent with poor income. ($S_1 < 0.5$ implies the income is enough to allot certain amount of money for the children's educational expenses)

$S_2 \geq 5$ Private schools do not admit students whose parental income is low or educational qualification is low ($S_2 < 5$ imply private schools admit poor students with no educational qualification for parents)

$S_3 \geq 0.5$ poor students find themselves out of place in rich or moderate private schools ($S_3 < 0.5$ implies poor students feel at home in the rich or moderate private schools)

$S_4 \geq 0.5$ Private schools promote english… (<.5 rural students do not face problems due to english…)

$S_5 \geq 0.4$ school infra structure which is required for normal academic growth ($S_5 < 0.4$ implies infra structure in the schools are not adequate for proper academic, physical and emotional growth)

$S_6 \geq 0.4$ adequate number of qualified and committed teachers who have interest in the welfare and development of poor students ($S_6 < 0.4$ implies inadequate number of teachers who could really help the poor children)

$S_7 \geq 0.5$ often government schools lag behind in good teaching and discipline… (< 5 government schools provide good teaching and discipline and have not many school dropouts)

$S_8 \geq 0.6$ capacity and commitment of the teachers to motivate, encourage and help poor students in their studies, problems and future plans ($S_8 < 0.6$ implies that the teachers are either incapable of or do not motivate or encourage or help the poor students)

The following are the attributes related with the children.

$C_1 \geq 0.5$ inability of the parent's to pay school fees and other expenses ($C_1 < 0.5$ implies that the parents are in a well off position to pay the fees and other expenses)

$C_2 \geq 0.5$ income and educational level of parents is extremely inadequate ($C_2 < 0.5$ implies that the educational level and parental income is sufficient to help the children in their studies)

$C_3 \geq 0.6$ parents are not motivated and unable to grasp the importance of education ($C_3 < 0.6$ implies that the motivational level of parents about the importance of education is enough).

$C_4 \geq 0.4$ children get into bad company of friends and dropout of school ($C_4 < 0.4$ implies that the children do not drop out of schools due to bad company)

$C_5 \geq 0.4$ children have to go for work even for a meager salary ($C_5 < 0.4$ implies that the children need not have to go for any sort of work for the little earning they get)

$C_6 \geq 0.3$ step parents make them as child labourers ($C_6 < 3$ step parents do not make them as child labourers)

$C_7 \geq 0.4$ poor children are discouraged and ridiculed in the school by teachers ($C_7 < 0.4$ implies that the poor children are not discouraged by the teachers)

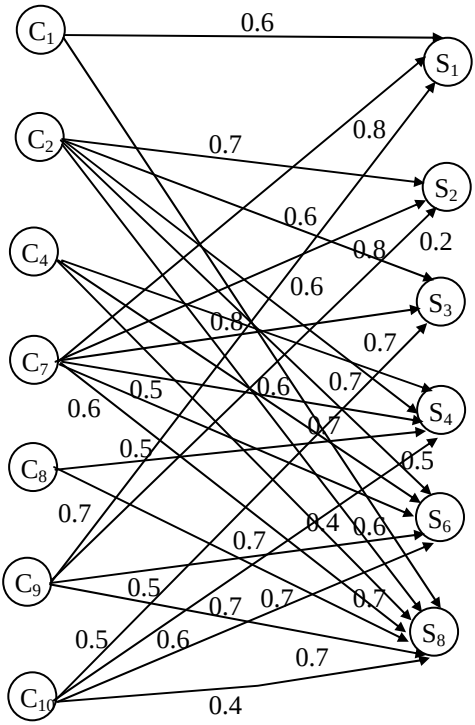
$C_8 \geq 0.4$ Children have to walk a long distance to reach school … ($C_8 < 0.4$ schools are at a reachable distance with good road facilities)

$C_9 \geq 0.4$ Due to gender difference female children are stopped from school to do house hold job ($C_9 < 0.4$ no such gender difference exist)

$C_{10} \geq 0.5$ Indifferent attitude on the part of government as the children do not form the vote bank for the politicians during the elections ($C_{10} < 0.5$ implies that the government takes care of the child issues or finds a solution for their problem at the peripheral level that solving at the level of the root cause for their problems)

The opinion of the expert who is a school drop and who works in a hotel has given the following sagittal diagram.

Now we give the sagittal diagram given by the expert.



We need the small modification of the Fuzzy Relational Equations.

Suppose P o Q = R we would be given two of the matrices we have to find the third one. It is pertinent to mention here that the equation P o Q = R need not always have a solution when they are used in engineering problems.

The condition may not be the same for social problems so we make small amendment by making it always possible to get the solution for by making P^t o R = Q if R is given and so on, as we are not having any expected or targeted values which is prefixed.

Suppose P is the matrix associated with the sagittal diagram.

$$P = \begin{array}{c} \\ C_1 \\ C_2 \\ C_4 \\ C_7 \\ C_8 \\ C_9 \\ C_{10} \end{array} \begin{array}{c} \begin{array}{cccccc} S_1 & S_2 & S_3 & S_4 & S_6 & S_8 \end{array} \\ \begin{bmatrix} 0.6 & 0 & 0 & 0 & 0 & 0.6 \\ 0 & 0.7 & 0.6 & 0.7 & 0.5 & 0.7 \\ 0 & 0 & 0 & 0.8 & 0.6 & 0.7 \\ 0.8 & 0.8 & 0.7 & 0.6 & 0.5 & 0.6 \\ 0 & 0 & 0 & 0.7 & 0 & 0.7 \\ 0.5 & 0.2 & 0 & 0 & 0.4 & 0.5 \\ 0 & 0 & 0.5 & 0.6 & 0.7 & 0.4 \end{bmatrix} \end{array}.$$

Suppose Q = (0.6 0.2 0.3 0.4 0.5 0.6) be the supplied matrix to solve the equation P o Q^t = R.

We use the max min operation and find the expected value of R.

Now P o Q^t = R, we use the max min operation and get R as follows:

R^t = (0.6 0.6 0.6 0.6 0.6 0.5 0.5).

We see if the expert takes that parents of a poor student can pay fees private schools do admit poor students with parents whose educational qualification is low, poor students feel at home in rich or moderate private schools, private schools promote more English than vernacular as a problem in free communication, Government schools do not have adequate number of qualified teachers etc., and both private and government schools do not have many teachers who motivate the students to be row matrix he wants to work with to find the solution or the expected result relating the students is given by the equation P o Q^t = R^t = (0.6 0.6 0.6 0.6 0.6 0.5 0.5).

We see parents of the poor are not in a position to pay high fees and parents of the poor are not in a position to help their children do home work or in studies or at the worst send them to tuition classes.

Children easily get into bad company and become school dropouts, poor children are discouraged by the teachers and are ridiculed before other students for no fault of these children, children have to walk a long distance to reach school so they dropout of school, due to gender difference female children are stopped from attending the class and government is indifferent to the problems faced by these students as they are not the vote bankers and no punishment is imposed on them who practice child labour.

We have all the nodes (C_1, C_2, C_4, C_7, C_8, C_9, C_{10}) exist and none of them is false and they are well ahead the stipulated value given by the expert.

It is thus concluded that poverty is a vital cause followed by lack of literacy on the side of poor parents whose children are school dropouts as parents are incapable of assisting their children in home work and day to day studies; these children seek the bad company as they are not motivated in studies and ridiculed and discouraged by teachers, there are no school near by their home nor they have good road facilities to go to school; so female children are not sent to school finally government keeps a indifferent attitude towards children's issues as they are not vote banks and people are favouring child labour or promotes dropouts.

Let us now consider a row vector associated with the causes relating school dropouts to find the attributes associated with educational institutions.

Let $Q = (0.5 \;\; 0.6 \;\; 0.6 \;\; 0.2 \;\; 0.2 \;\; 0.4)^t$ to find R using max min operation.

Now P o Q = R; gives

$R = (0.5 \ \ 0.6 \ \ 0.4 \ \ 0.6 \ \ 0.4 \ \ 0.5 \ \ 0.5)^t$.

We see if school fees is too high to pay etc as node then consequently parents inability to pay high school fees, their income and educational level are at a disadvantageous state but this does make the children get into bad company, the children are discouraged and ridiculed by teachers, children do not have a good school near by and gender differences forces them to make the female children work at home and finally the indifferent and non motivating attitude of the teachers of both private and government schools forces them to leave school become school dropouts.

We see poverty is the major reason for all the other evils follow.

Another important factor is teachers careless attitude of ridiculing these children for no fault of theirs.

Above all the indifferent attitude of the teachers and they fail to motivate the children of the values of education.

All these becomes a flouring ground for the increasing of the school dropouts which in turn increases the child labour.

Finally we work with the attributes relating children who dropout of school that is P o Q = R where P and R is known. To find Q.

That is using P^t o R = Q^t where Q gives the required result.

Let the R given by the expert be

$$R = \begin{bmatrix} 0.6 \\ 0.5 \\ 0.3 \\ 0.5 \\ 0.7 \\ 0.6 \\ 0.5 \end{bmatrix}.$$

Now P^t o R = Q^t that is

$$\begin{bmatrix} 0.6 & 0 & 0 & 0.8 & 0 & 0.5 & 0 \\ 0 & 0.7 & 0 & 0.8 & 0 & 0.2 & 0 \\ 0 & 0.6 & 0 & 0.7 & 0 & 0 & 0.5 \\ 0 & 0.7 & 0.8 & 0.6 & 0.7 & 0 & 0.6 \\ 0 & 0.5 & 0.6 & 0.5 & 0 & 0.4 & 0.7 \\ 0.6 & 0.7 & 0.7 & 0.6 & 0.7 & 0.5 & 0.4 \end{bmatrix} \text{ o}$$

$$(0.6 \;\; 0.5 \;\; 0.3 \;\; 0.5 \;\; 0.7 \;\; 0.6 \;\; 0.5)^t$$

Using max min operation we get $Q^t = \begin{bmatrix} 0.6 \\ 0.5 \\ 0.5 \\ 0.7 \\ 0.5 \\ 0.7 \end{bmatrix}$.

Thus Q = (0.6 0.5 0.5 0.7 0.5 0.7).

We see private schools charge a high fee and conduct entrance exams, illiterate poor parents cannot admit their children, private school develops a caste and class culture which makes the poor students out of place, private school promote

English more than vernacular so as first generation learners find it difficult to study.

Not adequate qualified teachers in government schools and they never teach in class finally both government and private school teachers never motivate the children about importance of education. All add to the school dropouts and their by increases the child labour.

We have worked with different sets of attributes. The major result from this model is poverty is a major cause followed by illiteracy, teachers arrogant attitude of insulting the children for no fault of theirs and finally teachers irresponsible way of not teaching and motivating the children about values of education.

Private schools tend to make money, government school teachers never teach and take some other side business to earn apart from the pay as teacher from the government. Unless government makes some strong rules to suspend the erring teachers who form the majority; this horrible plight can never be changed. Motivating teachers alone can make miracles in decreasing the school dropouts.

Chapter Four

SCHOOL DROPOUTS AS CHILD LABOURERS

In the chapter three, we have studied the causes of school dropouts. Here we study school dropouts as child labourers in tea shops and hotels, carpet, bangle, fire work, pottery industries, domestic servants using fuzzy models like BAM and FAMs etc.

One of the major human rights violations in the world is child labour, child labour is increasingly rampant in the Indian society. The approach to child labour problem is often status-quoist, and at other times casteist, and no political group is willing to divert its energies towards the solution of this problem. While India's communist parties blame child labour solely on poverty, the right-wing parties view child labour as essentially skilled labour that has to be utilized. NGOs and other volunteer organizations of course, have their intervention and rescue programs; but unfortunately not all NGOs working towards the eradication of child labour are above board, some of them pump up the figures, in order to obtain substantially greater amounts of funds. While this haunts the child labour problem, we decided to study the lives of child labourers, in

order to comprehend the larger social problem of school dropouts. We chose to study child labourers who are employed in restaurants, hotels, tea-shops and other eatery joints. For the purpose of our study, we have selected a sample of 50 children from the age group 11 to 18 years who are employed in small tea-shops and mini-hotels in Kasimedu, Chennai in Tamil Nadu. We queried into their backgrounds, their ambivalence towards education etc,.

We found out among our sample that only five of the children were not interested in reading; for the rest of them, education was stopped due to poverty. The children labour on an average for ten hours. They also mentioned pathetically that their earning was crucial for the subsistence of their families. Among the 50 children interviewed, 46 belonged to the oppressed Dalit community and 4 were from the Most Backward Castes (MBC). Their earning were meager and ranged from Rs. 20 to Rs. 35 per day.

We have used Fuzzy Associative Memories (FAM) to analyse this system and derived interesting conclusions.

1. It is evident when school dropouts are on the increase the social status of child labourers is bad and poverty forces them to take labour with under-employment as livelihood.

2. Every government / private school should give a specific percentage of seats for the poor children living around the locality of the school with complete free education and provide them with free uniform, food and other facilities so that they do not become dropouts.

3. The government laws should be made very strict so that child labour is not practiced.

4. The money motivated businessmen and industrialists should become more humane and not use child' labour to earn money.

5. Several inferences and views from experts show that if child labour is totally stopped the unemployment problem would be eradicated and would open up job opportunities for 60 million adults.

The child labour problem happens to be one of the least important problems for the politicians or government in general. The main reason given for this by social scientists is that child labourers are not vote banks and most of the child labourers are only from the deprived section of people and oppressed class of people like MBC, OBC, SC and ST. Several researchers have studied about child labourers working in match factories, bangle industries, beedi factories etc. But to the best of our knowledge the study of child labourers working in small tea-shops and hotels who are mostly children from villages has been analysed using fuzzy theory.

Here we, by direct interviews with these children, have gathered the following information. The study includes their caste, their work, family background and the cause of becoming child labourers. We have interviewed around 50 children working in tea shops and small hotels in Kasimedu area in Chennai. We list their views and news about their socio-economic background.

1. All these children are from poor or very poor society.

2. The main source of their family income was from working as agriculture labourers and they have been doing only this job over many generations.

3. They do not own lands but have a hut and a surrounded space where they cultivate vegetables, groundnuts, etc., apart from working as labourers for the land owners.

4. They are regularly affected with health problems during the time of spraying pesticides and insecticides and while manuring the plants.

5. Now the problem is most of the land owners complain that their land has lost the fertility only in this near future, that is after using the modern manures, pesticides and insecticides as advertised in T.V. or Radio and advised by the agriculture experts. Some of them who were farmers doing farming over 70 to 80 years complained that these modern manure and seeds has drastically brought down the yield and fertility of land. Hence the labourers were not paid properly (Pay was usually only proportional to the yield).

6. Every family of these child labourers have a strength varying from 5 to 10 (roughly). So to save the family from starvation their children have discontinued their studies and have come to city to work as child labourer. Their main work is washing vessels and cleaning the tables and left overs.

7. Most of them are in a way happy for they earn from Rs. 500 to Rs. 700 per month and get free boarding and lodging from the owners.

8. They mainly suffer with malaria, fever, cold and they have bad skin ailments in the palms and feet due to long hours of remaining in water and soap powders (which are abundant in chemicals) which are used for cleaning.

9. Only 2% of them did not continue studies due to dislike, others were really not only good in studies but like to be educated.

They felt if Government could give some monthly stipend these children certainly will be completing their school final and go for some decent job. Several, nearly 85% of the children felt they should be given free books, note-books, food and some money should be paid to their poor parents on monthly basis to see that they were not stopped from education and made to toil as child labourers.

Socio-scientists are of the opinion that the Government is not spending the money on Dalits and their children. Only the item of "Welfare of Dalits" finds its place in budgets, but is never rigorously implemented. They receive no help from the Government so they end up as child labourers.

Most of them feel that their future is bleak and their health conditions are poor even before they reach an age of 18. However, 75% of the child labourers felt their owners were unconcerned of their health problems and will not spend or give money for medical expense, but pay only on the basis of work they do each day.

Thus we study this problem of child labour mainly in the context of failure of agriculture and no support from the Government to help the coolies who work as agriculture labourers under the landlords.

Let us assume there are n attributes say $x_1, \ldots, x_n$ where n is finite associated with the child becoming a child labourer and let $y_1, \ldots, y_p$ be the attributes associated with the Government which does not control or take any steps to stop child labour, where p is finite.

On the suggestion of the experts and the child labourers the following attributes are taken.

C_1 - Acute poverty.

C_2 - Failure of agriculture.

C_3 - No means to food then how to continue education hence dropout, so has become child labourers.

C_4 - Tea shops and petty hotels provide job with food and shelter.

C_5 - Long hours of work and related health problems.

The qualities / attributes associated with the Government are:

G_1 - No steps taken by Government to provide alternatives when agriculture has failed.

G_2 - Government has not taken any legal remedies to prevent child labourers.

G_3 - No education with monthly stipend for school children in villages whose life is miserable.

G_4 - Child labourers are not vote banks so no concern over their welfare.

Here we analyze this problem only on the aspect that failure of agriculture has made them to take up job in tea shops, as all the child labourers belonged to only families from agriculture labourers who had worked as coolies under landlords.

The related fuzzy matrix of the FAM, M formulated using the experts opinion is as follows:

$$M = \begin{array}{c} \\ G_1 \\ G_2 \\ G_3 \\ G_4 \end{array} \begin{array}{c} \begin{array}{ccccc} C_1 & C_2 & C_3 & C_4 & C_5 \end{array} \\ \begin{pmatrix} 0.8 & 0.9 & 0.6 & 0.8 & 0.4 \\ 0 & 0 & 0.2 & 0.7 & 0.9 \\ 0.5 & 0.6 & 0.6 & 0.9 & 0.6 \\ 0 & 0 & 0 & 0.9 & 0.4 \end{pmatrix} \end{array}$$

$$\text{and } M^t = \begin{pmatrix} 0.8 & 0 & 0.5 & 0 \\ 0.9 & 0 & 0.6 & 0 \\ 0.6 & 0.2 & 0.6 & 0 \\ 0.8 & 0.7 & 0.9 & 0.9 \\ 0.4 & 0.9 & 0.6 & 0.4 \end{pmatrix}.$$

Consider a fit vectors B = (1 0 1 0 1);

i.e., (C_i) acute poverty, (C_3) no means for getting food so to continue education becomes impossible and (C_5) the child labourers work for long hours and later suffers from work-related health problems are taken as ON state of the fit vector. We compute the recalled component by taking the fuzzy inner product of fit vector with jth column of M for each column using the max min operation.

$$\max \min \{B, M^T\} = B \circ M^T = A = (0.8 \ \ 0.9 \ \ 0.6 \ \ 0.4).$$

According to the fit vector A, we see that the Government has not taken any legal remedies to prevent child labour which has the maximum value 0.9.

Secondly the fit vector reads no steps taken by Government to provide alternative job opportunities when agriculture has failed with second maximum value 0.8. The Government is not providing education with monthly stipend is the third graded value.

Taking the resultant A, as the fit vector now we calculate $\max \min \{A, M\} = A \circ M$.

i.e., $A \circ M = (0.8 \ \ 0.8 \ \ 0.6 \ \ 0.8 \ \ 0.9)$.

Since 0.9 is the largest value, it implies that the priority is given to the child labourers who work for long hours and suffer with work related health problems i.e., occupational diseases. Thus according to this expert, the first place is given to C_5.

The next largest value is 0.8 given to the attributes C_1, C_2 and C_4 where acute poverty and failure of agriculture has forced them to take protection and refuge in tea-shops.

Now suppose we consider the fit vector $B_1 = (1 \ 0 \ 0 \ 0 \ 1)$, acute poverty and long hours of labour and related health problems to be in the ON state. Consider $\max \min \{B \circ M^T\} = B_1 \circ M^T$, as before we compute by recalling fit vector as

$$B_1 \text{ o } M^T = (0.8 \ \ 0.9 \ 0.6 \ \ 0.4).$$

Thus from this resultant fit vector we see that the ON state of C_3 does not influence the model the resultant fit vector is the same.

Suppose we take $A_1 = (1\ 0\ 1\ 1)$ which implies that (G_1) no steps have been taken by the government to provide alternative when agriculture has failed; (G_3) no education with monthly stipend for school children in villages whose life is miserable, and (G_4) child labourers are not vote banks so no concern about their welfare, are in the ON state.

We get

$$\max \min \{A_2, M\} = A_2 \text{ o } M = (0.8 \ \ 0.9 \ \ 0.6 \ \ \ 0.9 \ \ 0.4).$$

The highest cause being failure of agriculture and tea shops provide them free food and shelter; 0.9 followed by 0.8 acute poverty followed by 0.6 no means to food so how to continue education and least importance 0.4 is given for long hours of work and health related problems.

We give the conclusions and suggestions from our study.

Along with the conclusions drawn from our study, based on the FAM model discussed in this chapter and from experts opinion which are obtained using linguistic questionnaire, we give the following suggestions:

1. Government should take legal steps to eradicate child labour. Implementation of existing laws must be made stringent.

2. Unless Government takes steps to provide alternative methods for failure of agriculture and health related problems of child labours cannot be stopped.

3. Increase in child labour certainly increases the school dropouts. Steps must be taken to retain children in schools.

   The only suggestion for this is the children who are from these agriculturist labour families should be given not only free school education but given free note books and books, food and above all an incentive of monthly stipend to the children ranging from Rs. 500 to Rs. 700 as only for this money they have fled from their villages to toil over 12 hours a day.

   Most of the children belong to the most deprived class of people Dalits and no welfare schemes by the Government ever really reaches them. Such steps will certainly, not only decrease the number of child labourers but also will decrease the school dropouts.

4. It is not sufficient if Government gives them free ration rice but give their children education and the adults should be given some alternative employment opportunity.

To the best of everyone's knowledge, no proper measure is taken legally or even humanly to save child labourers. A major reason is the lack of political will.

The inaction is basically due to the fact that children are not vote banks. Child labour is often thought to be an upshot of poverty, unemployment and illiteracy. But the truth is that, it is the root cause of all these maladies.

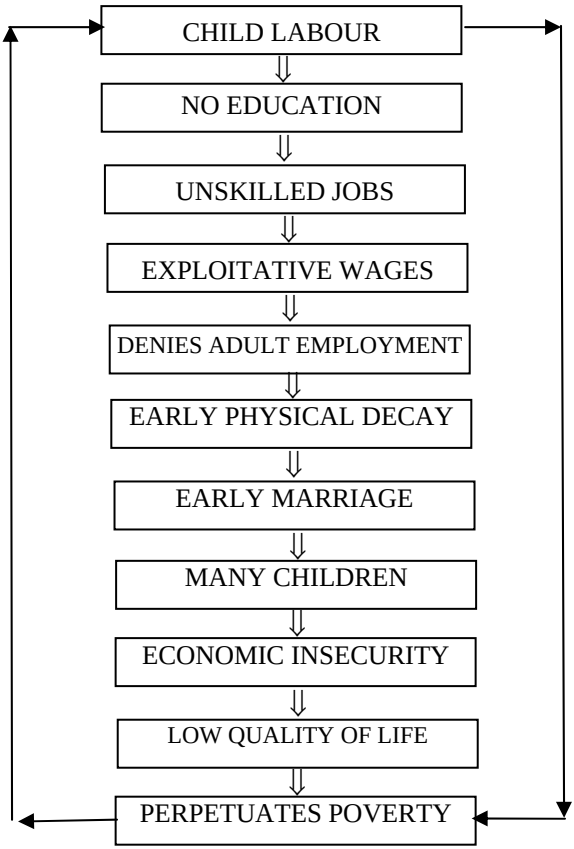
If child labour is eradicated, about 60 million adults would get employment. The average dropout rate from primary schools in India is 40%, despite the desire of the children to learn. Motivated by these facts, and with a view to understand the root cause, we make suggestions derived from our study.

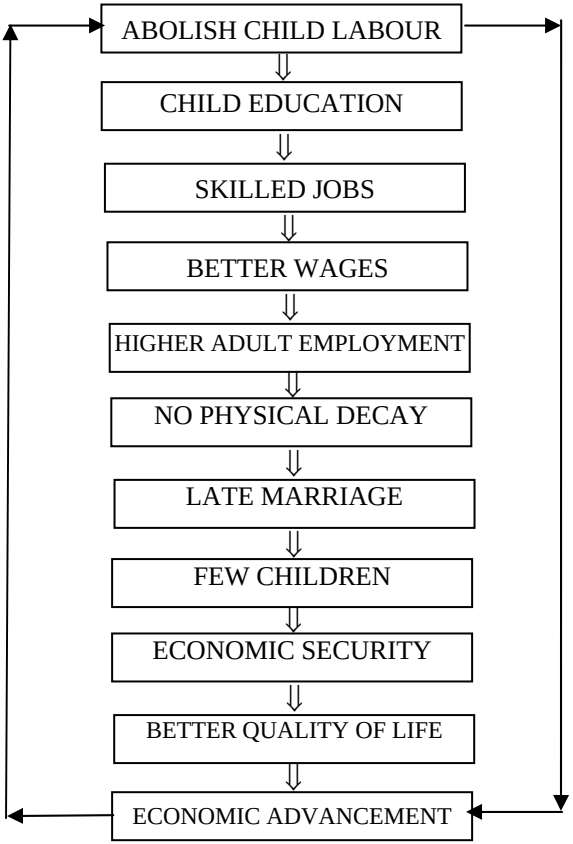
We have approached the problem using fuzzy theory in general and Bi-directional Associative Memories (BAM) in particular.

We are justified in using BAM model since no solid reason for child labour is found but the child labour is at its supremacy and almost every factor related to the child labour are vague.

The state in which the child labourers live as a result of working at too early an age and the effects that it leads to when child labour is abolished is given by the following two flow charts which are self-explanatory.

The child labourers in hotels, carpet, bangle, fire work, pottery industries, domestic servants using BAM.





Here we do not deal with child labour and its abolition but we mainly study interrelation between

(a) flourishing of the child labour and government policies and

(b) role of public in encouraging child labour.

(We are justified in making the above statement for if the public does not encourage child labour, certainly the number of child labourers in India would not be over 60 million)

From (a) and (b) we obtain the relation between the public and the government regarding the child labour problem. To study these problems we adopt Bidirectional Associate Memories (BAM) model based on the experts opinion. BAM model is briefly described in the chapter two of this book.

The flourishing of child labour is mainly due to the public who do not have a social sense that child labour is a biggest violation of human rights and the government who is yet to bring efficient and severe punishment on public / individuals who practice child labour. Nothing has become legal even for those who practice child labour and when found or penalized, do not pay to the court. Thus the government in true sense is not taking any steps to prevent child labour because children are neither votebanks (like the industrialists) not financiers for them.

So we felt it would be proper to adopt the BAM model.

The problem is divided under two broad titles.

1. Government policies preventing / helping such child labour.

2. Public awareness and child labour.

We take some subtitles for each of these two main titles. Here we do not state that we have exhausted all the subtitles in this study. For the sake of simplicity and illustrative difficulties we have taken some of the major subtitles, which are of primary interest to most of the experts.

In our illustration, we have taken for both the models on the scale –5 to 5. This is done purely for easy and explicit comparison. Though from our study, the scale does not have any effect on the final conclusions. Further we had taken 20 experts, from educationalists / teachers, social workers/NGOs, sympathetic public, parents of child labourers, and child labourers themselves.

Only opinions of two experts are illustrated in this book whereas the conclusion given from our study is derived from all the experts.

The attributes associated with the children working as labourers are:

C_1 : Abolition of child labour

C_2 : Uneducated parents

C_3 : School dropouts/never attended any school

C_4 : Social status of child labourers

C_5 : Poverty / source of livelihood

C_6 : Orphans, runaway, parents are beggars, father in prison

C_7 : Habits like cinema, smoking, alcohol etc.

The attributes associated with government policies preventing / helping such child labour are:

G_1 : Child do not form votebank

G_2 : Business men / industrialists who practice child labour are the main source of votebank and finance to the politicians

G_3 : Free and compulsory education for children

G_4 : No proper punishment by the government for the practice of child labour.

The attributes associated with public awareness and support of child labour are:

P_1 : Cheap and long hours of labour from children

P_2 : Children as domestic servants

P_3 : Sympathetic public

P_4 : Motivation by teachers to children to pursue education

P_5 : Perpetuating slavery and caste bias.

The experts were asked to answer the linguistic questionnaire prepared for this study. If they were not educated enough to read and understand the questionnaire, we noted their answers after discussions with them. From these linguistic questionnaire we got a feedback about the important attributes which were uniformly emphasized by most of the experts.

Now we give the BAM Model using the expert's opinion connecting the flourishing of child labour and government policies.

Taking the neuronal field F_x as the attributes connected with the child labour and the neuronal field F_Y as the policies of the government. The 7×4 matrix M_1 represents the forward synaptic projections from the neuronal field F_x to the neuronal field F_Y. The 4×7 matrix M_1^T represents the backward projections from F_Y to F_x. Now, taking $C_1, C_2, \ldots, C_7$ along the rows and G_1, G_2, G_3 and G_4 along the columns we get the synaptic connection matrix M_1 which is as follows:

$$M_1 = \begin{bmatrix} 4 & -2 & 3 & -2 \\ 0 & 3 & -1 & 0 \\ 0 & 4 & -2 & 2 \\ 0 & 3 & 1 & 0 \\ 0 & 2 & -1 & 1 \\ 2 & 3 & -2 & 3 \\ 0 & 2 & -2 & 1 \end{bmatrix}$$

Let X_k be equal to (–4, –3, 1, 2, 5, –3, –1), the initial input vector. The initial input vector is given such that school droupouts, social status of children and poverty have a greater impact on the problem of child labour.

Let us suppose that all neuronal state change decisions are synchronous. The binary signal vector $S(X_k) = (0\ 0\ 1\ 1\ 1\ 0\ 0)$.

Using the activation equation and after carrying out at each stage the thresholding and updating of the vectors we get the following equations:

$$
\begin{aligned}
S(X_k) \times M_1 &= (0, 9, -2, 3) \\
&= Y_{k+1} \\
S(Y_{k+1}) &= (0\ 1\ 0\ 1) \\
S(Y_{k+1}) \times M_1^T &= (-4\ 3\ 6\ 3\ 3\ 6\ 3) \\
&= X_{k+2} \\
S(X_{k+2}) &= (0\ 1\ 1\ 1\ 1\ 1\ 1) \\
S\ (X_{k+2})\ M_1 &= (2, 17, -7, 7) \\
&= Y_{k+3} \\
S(Y_{k+3}) &= (1\ 1\ 0\ 1) \\
S(Y_{k+3}) \times M_1^T &= (0\ 3\ 6\ 3\ 3\ 8\ 3) \\
&= X_{k+4} \\
S(X_{k+4}) &= (0\ 1\ 1\ 1\ 1\ 1\ 1).
\end{aligned}
$$

The binary pair {((0 1 1 1 1 1 1), (1 1 0 1))} represents a fixed point of a BAM model or the dynamic system. Equilibrium for the system occurs at the time k + 4 when the starting time was k.

This fixed point suggests that school dropouts, social status and poverty has an important role in the government neglecting the children as they are not vote banks and encouraging the exploitation by the businessmen and industrialists to practice child labour.

Further, this encourages the person who practice child labour go unpunished by the government.

Making education free and compulsory by the government remains in the OFF state predicting that the ON state of C_3, C_4 and C_5 discourages compulsory and free education by the government. Similarly, by taking a vector Y_R one can derive conclusions based upon the nature of Y_k.

We use the BAM Model of the Experts' Opinion Connecting the Flourishing of Child Labour and the Role Played by the Public.

Taking the neuronal field F_x as the attributes connecting with the child labour and the field F_Y as the role of the public, the 7×5 matrix M_2 represents the forwards synaptic projections from the neuronal field F_x to the neuronal field F_Y. The 5×7 matrix M_2^T represents the backward projection from F_Y to F_R. Now, taking C_1, C_2, …, C_7 along the rows and P_1, P_2, …, P_5 along the columns we get the synaptic connecting matrix M_2 is as follows:

$$M_2 = \begin{bmatrix} -3 & -2 & 2 & 0 & -1 \\ -4 & 3 & 0 & -1 & 2 \\ 3 & 2 & -2 & -3 & 3 \\ -2 & -1 & 1 & 2 & -3 \\ 4 & 3 & 2 & 0 & 3 \\ 4 & 3 & -2 & -1 & 3 \\ 2 & 0 & -2 & -2 & 0 \end{bmatrix}$$

Let X_k be equal to (–4, –3, 1, 2, 5, –3, –1) be the initial input vector. The initial input vector is given such that school dropouts, social status of children and poverty have a greater impact on the problem of child labour.

Let us suppose that all neuronal state change decisions are synchronous. The binary vector $S(X_k)$ = (0 0 1 1 1 0 0). From the activation equation $S(X_k) \times M_2 = (5\ 4\ 1\ -1\ 3) = Y_{k+1}$.

The new signal vector is $S(Y_{k+1})$ = (1 1 1 0 1).

Now

$S(Y_{k+1})\, M_2^t = (-4\ 1\ 6\ -5\ 12\ 8\ 0) = X_{k+2}$

So that $S(X_{k+2}) = (0\ 1\ 1\ 0\ 1\ 1\ 0)$

Now $S(X_{k+2}) \times M_2 = (7\ 11\ -2\ -5\ 11) = Y_{k+3}$

$S(Y_{k+3}) = (1\ 1\ 0\ 0\ 1)$

$S(Y_{k+3}) \times M_2^T = (-6\ 1\ 8\ -6\ 10\ 10\ 2) = X_{k+4}$

$S(X_{k+4}) = (0\ 1\ 1\ 0\ 1\ 1\ 1)$

Now

$S(X_{k+4}) \times M_2 = (9\ 11\ -4\ -7\ 11) = Y_{k+5}$

Thus $S(Y_{k+5}) = (1\ 1\ 0\ 0\ 1)$.

Thus the binary pair {((0 1 1 0 1 1 1), (1 1 0 0 1))} represents the fixed point of the BAM dynamical system.

This fixed point suggests that school dropouts, social status of child labourers and poverty has a major impact on the public to adopt these children as cheap labourers, domestic servants and perpetuating slavery and caste bias.

These three aspects however have no impact in generating sympathy in public or the motivation by teacher to the children to pursue education. Similarly, by taking Y_k as any initial input vector we can find the fixed point of the BAM and interpret the fixed point of the dynamical system accordingly.

We just give the interrelations regarding child labour views between public and government and the conclusions derived from our study.

We have taken in the study the initial input vector for both the BAM models. M_1 and M_2 as $X_k = (-4, -3, 1, 2, 5, -3, -1)$. The initial input vector is given such that school dropouts, social status of children poverty has a greater impact on the problem of child labour.

The fixed points given by the BAM dynamical systems M_1 and M_2 are {((0 1 1 1 1 1 1), (1 1 0 1))} and {((0 1 1 0 1 1 1), (1 1 0 0 1))} respectively.

The results obtained from the analysis of the fixed point are as follows:

When the school dropouts are on the increase, social status of the child labourers is bad and poverty forces them to take child labour as the livelihood and the government does not provide free and compulsory education.

On the other hand, the government encourages the child labour indirectly by not implementing any proper punishments to the persons who practice child labour which in turn makes the businessmen and industrialist to deploy children as labourers in a very large scale.

Now regarding the public they are unsympathetic and no proper motivation is given by the teachers to the children to pursue education resulting in the increase of cheap labour by children. Children as domestic servants and finally perpetuating slavery and caste bias.

Technical conclusions derived from our study are that

1. Even when the scale was different for various experts, still the conclusions derived remained the same. So, we can technically conclude that the scales which we use do not affect the results.

2. We do not exclude the possibility that many more attributes related to the government policies, public feelings and child labourers could be taken. Certainly the increase in the number of attributes will make the study more sensitive.

This conclusion was derived when we used only 3×4 matrix the effect of which was not sensitive as compared to the effect when we used a 7×4 matrix.

3. We suggest a program can be constructed to make the study simple so that we can increase the number of attributes in all the three cases.

4. We can try to use a different linguistic questionnaire and thereby relate the failed government policies with public views, by which we can directly find a BAM model for them.

Following are the conclusions and suggestions derived from our study regarding child labour.

1. It is evident when school dropouts are on the increase the social status of child labourers is bad and poverty forces them to take labour with under-employment as livelihood.

2. Every government / private school should give a specific percentage of seats for the poor children living around the locality of the school with complete free education and provide them with free uniform and other facilities so that they do not become dropouts.

3. The government laws should be made very strict so that child labour is not practiced.

4. The money motivated businessmen and industrialists should become more humane and not use child labour to earn money.

5. Several inferences and views from experts show that if child labour is totally stopped the unemployment problem would be eradicated and would open up job opportunities for 60 million adults.

6. Child labour can be minimized if the parents of these children are paid a monthly incentive ranging from Rs. 600 to Rs. 700.
Minimizing child labour will minimize the school dropouts.

Chapter Five

SCHOOL DROPOUTS AS RAG PICKERS USING FUZZY MODELS

Here we study the life of those school dropouts who are also runaways taking up the profession of rag pickers. We have collected data from over 90 rag pickers in Chennai and used this data to find the health hazards faced by them using Fuzzy Relational Maps model.

Some of the basic reasons for these children becoming rag pickers are

(i) Poverty

(ii) Sensitive in nature

(iii) Self respect and independence of life

(iv) School dropouts

(v) Orphans etc.

We now describe briefly the problem.

The child labour problem happens to be one of the least important problem for the politicians or government in general. The main reason given for this by social scientists is that children (almost all the child labourers) are not vote banks and most of the child labourers are only from the deprived section of people and oppressed class of people like MBC, OBC, SC and ST.

Several researchers have studied about child labourers working in match factories, bangle industries beedi factories etc., but to the best of our knowledge the study of child labourers working in small tea-shops and hotels who are mostly children from villages has been analyzed using fuzzy theory. But rag pickers who can not be even fully classified under the child labourers are investigated in this book using fuzzy theory.

Here we by direct interviews with these children have gathered the following information. The study includes their caste, their work, family background and the cause of becoming child labourers.

Thus these 90 rag pickers are analyzed under eleven main heads; leaves family due to mother's death and cruelty by step mother, Bad company and bad habits, likes liberty, due to torture by employer - takes up rag picking, poverty and unemployment, school dropouts / no good school in the vicinity / no money to pay school fee / ill treatment by the teachers, failure of agriculture and employment opportunity at their home; land is lost.

Rag picking as a source of income and livelihood, quarrel at home with parents or family members, brought to city by middle men who promised job in the city but was forced them to begging or pick pocket; to escape from their clutches they end up as a rag pickers, left orphans due to parents or family members death, and father a drunkard / parents in jail.

Thus these gives the common socio and economic problems, which is faced by majority of the rag pickers.

Now we proceed onto give some information as reported from the dailies.

It is reported in a very popular daily like The New Indian Express, (July 21st 2001) "Thirteen Acres of Garbage in Nanganallur is a health risk" and on (7th July 2004), The New Indian Express reports about the garbage clearance; but no one is bothered about the rag pickers who dwell deeply in it for their shear living.

So in this book we deal with the health hazards faced by the rag pickers.

The social problems faced by the rag pickers in Chennai city is a very acute one and it mainly reflects on the self made child labour. These children labour due to the self respect which the child values / the independence the child wants to breath and it is not by force.

So we cannot even call this as child labour so only we call it as self made child labour. Majority of these rag pickers are children; school dropouts who have run away from their family due to some ill treatment / quarrel in their family. The living conditions of these rag pickers are very poor and in fact they suffer several health problems.

The health hazards faced by these rag pickers in Chennai City is very pathetic and they suffer these problems due to their profession (rag picking). Since most of the problems faced by these rag pickers starting from the cause, why they have become rag pickers and their mode of living social condition and above all their health problems happen to be a flimsy one which cannot be collected as a data or which cannot be described in terms of number. These rag pickers have no place to sleep in the night so they take to bad habits of drinking alcohol or using

self created drugs which keeps them in a state of complete sleep (unconscious for six to eight hours) during nights or they spend nights in cinema theaters by watching movies.

They say the places they sleep are platforms or places near garbage or gutter, which are full of mosquitoes or bugs. Some of them have sought such drugs purely for sleep, which they know, fully well is very injurious to their health even drastically affecting their longevity and so on.

At the outset we are justified in using fuzzy theory in general and fuzzy relational maps in particular. We have chosen the fuzzy tool especially fuzzy relational maps as the problems are interrelated with public and parents. i.e., as they have become rag pickers not of their own choice but by some external agents viz., parents and teachers.

Since the heath hazards suffered by them is also not due to their act but due to the very poisonous quality of the wastes and the waste management is done in an improper way, which is largely contributed, by the public and the government. We are forced to adopt FRM for this analysis.

To study and analyze this problem we have constructed a linguistic questionnaire and using this linguistic questionnaire we have interviewed 90 of the rag pickers. These linguistic questionnaire was used to obtain the attributes and using these attributes and the opinion of the experts we have used FRM to analyze the problem.

Now using these linguistic questionnaire and the experts opinion we have taken the following as the main attributes associated with the health hazards of the rag pickers and the influence of the public, parents and social circumstances.

Thus we take the problems faced by the rag pickers as the domain space and the cause of it is taken as the range space of the FRM. We have taken the following as the main attributes; it is not a hard and fast rule; one has to use only these attributes.

It is left to the choice of any researcher to include or exclude any of the attributes.

Attributes related to the Domain space D given by
$D = \{D_1, \ldots, D_6\}$

D_1 - Quarrel at home / ill treatment.

D_2 - School dropout.

D_3 - Rag picking as an independent profession.

D_4 - Poverty and seeks self respect.

D_5 - Take upto all bad habits due to several reasons like bad company, for sleep, etc., so become drug addicts.

D_6 - No hygiene / no knowledge about hygiene / about the hazardous waste they deal with.

D_7 - Run away from the family.

Attributes Related to the Range space R is given by
$R = \{R_1, \ldots, R_8\}$.

R_1 - Father a drunkard / no parents / mother dead / parents in jail.

R_2 - No motivation by teacher in school / no proper school.

R_3 - Enjoy independence / self support.

R_4 - No place to sleep in night.

R_5 - Problem given by police.

R_6 - Malaria / typhoid.

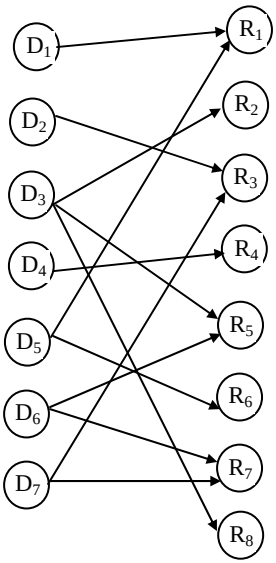
R_7 - Scabies / hepatics / skin ailment due to rag picking.

R_8 - Government and public has taken no steps to manage hazardous waste properly.

We from the linguistic questionnaire see that the rag pickers take to several bad habits like drinking, ganja etc lead to bad company or learn when they are in police custody with other criminals. They say they take drugs for sleep, as they cannot sleep in the nights in the roadside with mosquito biting and foul smell. Also they face several social problems like threat by police, for the public easily suspect them for any anti social events.

They are often taken into police custody for no fault of theirs. Further it is important to note that the wastes like medical waste, chemical waste which are very much injurious to their health are handled in bare hands at times they have open wounds in hands and limbs which are exposed to these poisonous waste, there by making the wounds septic and chronic. Thus we see these rag pickers are exposed to several health hazards not only due to waste but also due to bad habits.

The directed graph given by the expert is as follows:



Using the first expert's directed graph who is a rag picker for over a decade the following connection matrix was obtained.

$$A_1 = \begin{array}{c} \\ D_1 \\ D_2 \\ D_3 \\ D_4 \\ D_5 \\ D_6 \\ D_7 \end{array} \begin{array}{c} \begin{array}{cccccccc} R_1 & R_2 & R_3 & R_4 & R_5 & R_6 & R_7 & R_8 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}.$$

Suppose consider the effect of the on state of the node (i.e., school dropout) D_2 and all other nodes are in the off state.

The hidden pattern of the state vector X = (0 1 0 0 0 0 0) is obtained by the following method:

$XA \hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0) = Y$

$YA^T \hookrightarrow (0\ 1\ 0\ 0\ 0\ 0\ 1) = X_1$

$X_1A \hookrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 1\ 0) = Y_1$

$Y_1A^T \hookrightarrow (0\ 1\ 0\ 0\ 0\ 1\ 1) = X_2$

$X_2A \hookrightarrow (0\ 0\ 1\ 0\ 1\ 0\ 1\ 0) = Y_2$

$Y_2A^T \hookrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 1) = X_3$

$X_3A \hookrightarrow (0\ 1\ 1\ 0\ 1\ 0\ 1\ 1) = Y_3$

$Y_3A^T \hookrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 1) = X_4$ (say)

$X_4A \hookrightarrow (0\ 1\ 1\ 0\ 1\ 0\ 1\ 1) = Y_4$ (say)

(where ($\hookrightarrow$) denotes the resultant vector after thresholding and updating).

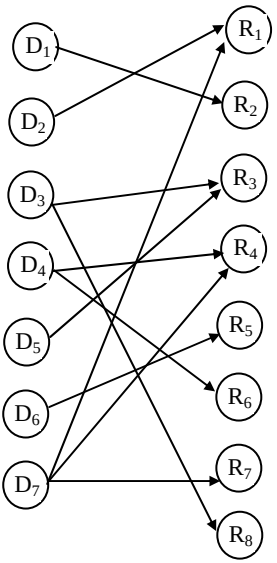
When we take school dropout i.e., D_2 in the ON state and all other attributes to be in the off state; we see the effect of X on the dynamical system A_1 is a fixed point given by the binary pair {(0 1 1 0 0 1 1), (0 1 1 0 1 0 1 1)}.

When we take the node school dropout alone in the on state we get say X = (0 1 0 0 0 0 0) the resultant to be the fixed point given by the binary pair {(0 1 1 0 0 1 1), (0 1 1 0 1 0 1 1)}.

We see when the on state is taken as node D_2 or D_3 we see the hidden pattern is the fixed point which is the same binary pair, which makes the nodes D_2, D_3, D_5 and D_7 to be in the on state in the domain space and makes the nodes R_2, R_3, R_5, R_7 and R_8 of the range space to be in the on state.

Since the working is time consuming we have formulated a C program for finding the hidden pattern.

The directed graph given by the expert is as follows:



The casual connection matrix A_2 of the directed graph given by the second expert who is a social worker is as follows:

$$A_1 = \begin{array}{c} \\ D_1 \\ D_2 \\ D_3 \\ D_4 \\ D_5 \\ D_6 \\ D_7 \end{array} \begin{array}{c} \begin{array}{cccccccc} R_1 & R_2 & R_3 & R_4 & R_5 & R_6 & R_7 & R_8 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

Suppose the state vector X = (0 1 0 0 0 0 0) i.e., the node school drop out is in the on state and all other nodes are in the off state.

We see the resultant binary pair using the C -program is given by {(0 1 0 1 0 0 1), (1 0 0 1 0 1 1 0)} which is the fixed point.

When we take the state vector X_1 = (0 0 0 0 0 0 1) i.e., the node run away from the family i.e., D_7 in the on state and all other attributes be in the off state we see the effect of X_1 on the dynamical system A_2 is a fixed point given by the binary pair {(0 1 0 1 0 0 1) (1 0 0 1 0 1 1 0)}.

The interpretation of the hidden pattern of several state vectors using several experts is used in this book to arrive at the conclusion.

To show the mode of working we have just given two experts opinion.

We give the conclusions and suggestion from our study.

1. The rag pickers must be approached by some social workers (who work on non profit basis) to advice these rag pickers about the health problems and the risks they face by rag picking.
2. Government must provide them freely good gloves, mask and shoes while going for rag picking.

3. These children should be given a place for sleep. It can be temple premises or the rooms of the schools of a corporation building for night sleep.

4. Steps must be taken to provide them free adult education in the night after work. (it is pertinent to mention here that certain groups are supporting a few of the rag pickers in the city).

5. Public must be provided with civic sense not to dump hazardous waste were rag pickers do the rag picking.

6. Government should take strong steps both to prevent the rag pickers around the hospital zone and also the hospital authorities not to dumb the dangerous and hazardous wastes which are reachable by the rag pickers.

7. The rag pickers are by nature very sensitive youth wounded by the parents / teachers who run away from homes for seeking self respect and independence, so they should be treated with respect by police and public.

8. Most of the rag pickers are very friendly, helpful but by force have taken upto bad habits. They take alcohol, drugs for undisturbed sleep in the nights, were the place of sleep is the waste land near the sewage or a place near the heap of garbage. They share place with stray dogs, pigs and stray cattle. (Who is responsible for all these?)

9. Most of them are school dropouts, taken this due to poverty / self-sufficiency / self respect / independence.

10. They are very much ignorant of the health risk they face and the dangers they are exposed to by doing this job of rag picking with bare hands and feet and with open wounds exposed to such dirt.

    In the next chapter we find the performance aspects of school students so that they become noble citizens of this nation.

Chapter Six

PERFORMANCE ASPECTS OF SCHOOL STUDENTS USING RULE BASED CONTROL SYSTEM

Here we just study what are essential steps to be taken by the education system to develop the performance aspects of school students. For once the performance aspects of school students are improved naturally the school dropouts will decrease. So here we study the performance aspects using rule based control system.

A rule based control system depends largely on the availability and the performance of the rule base. When there are no experts available at hand to supply knowledge about any problem, rule based control system can be used. Here for the first time we apply rule based control system to study the performance aspects of the school students. By performance aspects of school students we don't mean a student getting full or good percentage of marks or becoming eligible for a professional course. By performance aspects we mean the students life after the completion of his college education and later his position in society. i.e., his overall personality like

moral integrity, love for the nation, etc.; consequently it follows that there will be less number of school dropouts so it minimizes the school dropouts. The teacher is used as the controller or control actions (i.e., how best a teacher should be, thus only good nature of the teacher is used) to mould a student to posses at least more good qualities than the evil ones; i.e., whether the students presence is advantageous to society or disadvantageous to the society or is it indeterminable. To achieve this the input is taken as the students' nature and teacher is taken as control. The output seems to be heavily dependent on the teacher who is used as the control process.

From this study we infer that a devoted teacher with good moral values and understanding of the student's nature can certainly produce in future a responsible citizens in contrast to teachers who have no devotion to work and no interest in the profession, who works solely for money will at large produce citizens who can be dangerous to society.

The nations development depends on the citizens. If every citizen is trained at an early age to be a responsible one certainly the nation will tend towards development. This entirely depends on the early state of education, viz., school learning. So we have to analyse how far a teacher is responsible to make a good student using Rule Base Control System (R.B.C.S). To the best of our knowledge we are the first one to adopt this method to evolve the performance aspects of school students. We transfer this model into the Rule Base Control System (R.B.C.S.).

One of the most important and attractable characteristics of system structure is that only little explicit knowledge regarding the controlled process is needed while designing the controller. The overall System Structure (S.S). is composed of three processes.

1. Input process
2. Control process
3. Output process.

DEFINITION 6.1: In input process, student's nature is taken as input and is passed to the control process.

DEFINITION 6.2: Here the control process is teacher, who controls and influences the students performance depending on the input and final output gives the students position in the society.

DEFINITION 6.3: In output process we get the performance aspects of the students after control by the teacher is advantageous or disadvantageous to the nation.

DEFINITION 6.4: The rule base is extracted from the control and evaluated in terms of accuracy with respect to the student's nature. The structure of control process Rule Base Control System (R.B.C.S) is given in the following figure 1.

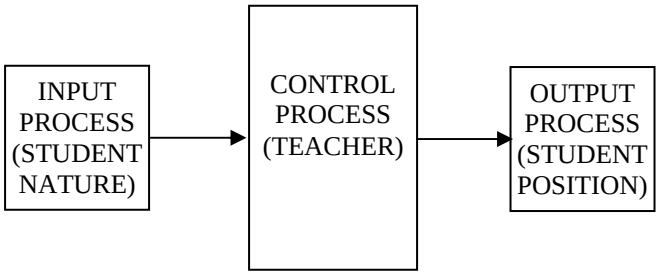


Figure 1. The Structure of R.B.C.S.

Today's problem is that the students waste their early life in a disadvantages manner. To control, i.e., to make the students life useful we apply this Rule Base Control System (R.B.C.S.) to study the performance aspects of school students and make the student perform their duties towards the nation in an advantageous manner. In this process we consider the students nature as input and teacher is used as the control process to control the students. While in the input we take both good and

bad aspects of the students. For instance we claim even the brain drain of students as disadvantages to our nation, as it means no love for nation, not only that the school drop outs can be reduced.

Here we describe the use of Rule Base Control System (R.B.C.S.) to study the problem:

To transform the problem into the Rule Base Control System (R.B.C.S.) one, we take the students nature as performance in studies, economic condition, social condition, family education, inherent nature and family background as input, which is described below.

We take the following qualities of teacher such as devotion to work, pay not the main motive, imparting not only education but also values of life, must take interest in each individual student, build a good character in the student by their association, marks is not used as means to judge the student and subject is well imparted and is used in control process system on the students, which is described below.

According to this control process, when used on the controlled, i.e., students we get the output as:

1. Student interest in studies

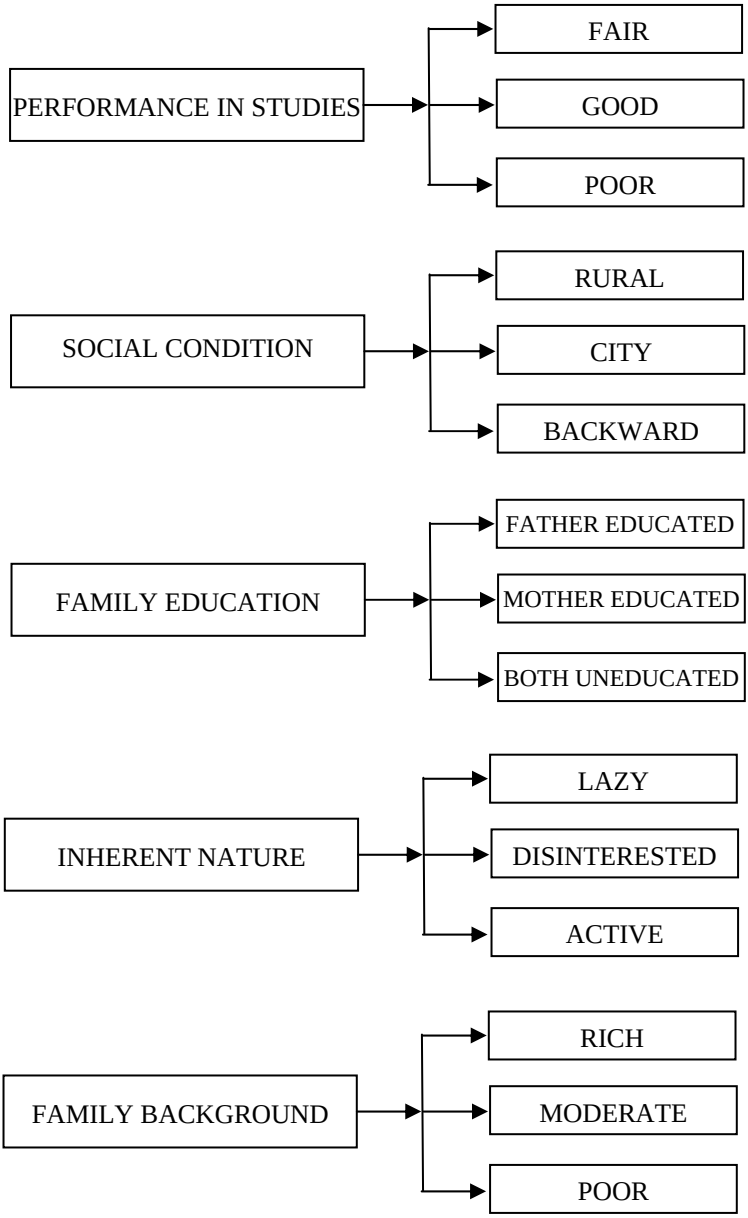
2. Willingness to study

3. Future ambition

4. Students association after school hours.

We use these activities in the output process to determine the student's position in the society. As we are using fuzzy based study our conclusions are given as either students presence is advantageous to the society which is denoted by A and disadvantageous to the society which is denoted by D and indeterminate is denoted by I.

Since all the requirements viz.,



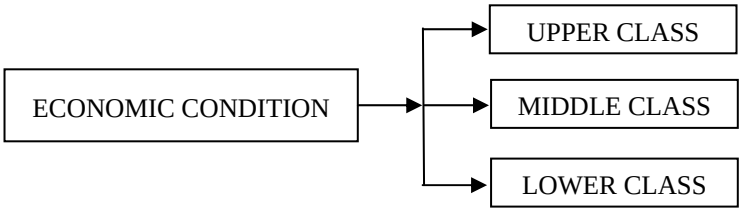


Figure 2 Input Process (Students Nature)

1. The control system using the Teacher as the controller will certainly satisfy the desired performance of the students, as good citizen of nation which is indicated by A otherwise by D.

2. We have only a limited knowledge about the process as the nature of the students cannot be well defined for they depend very much on various aspects and also vary from time to time depending on the circumstances of the life they face in their house hold.

3. The algorithm given in figure 2 and figure 3 are simple.

Hence the requirements to use the Rule Base Control System (R.B.C.S.) is completely satisfied now, using the Rule Base Control System (R.B.C.S.) we arrive at the output which is described in the following figure 4.

A – Advantageous of the Society

D – Disadvantageous of the Society

I – Indeterminate

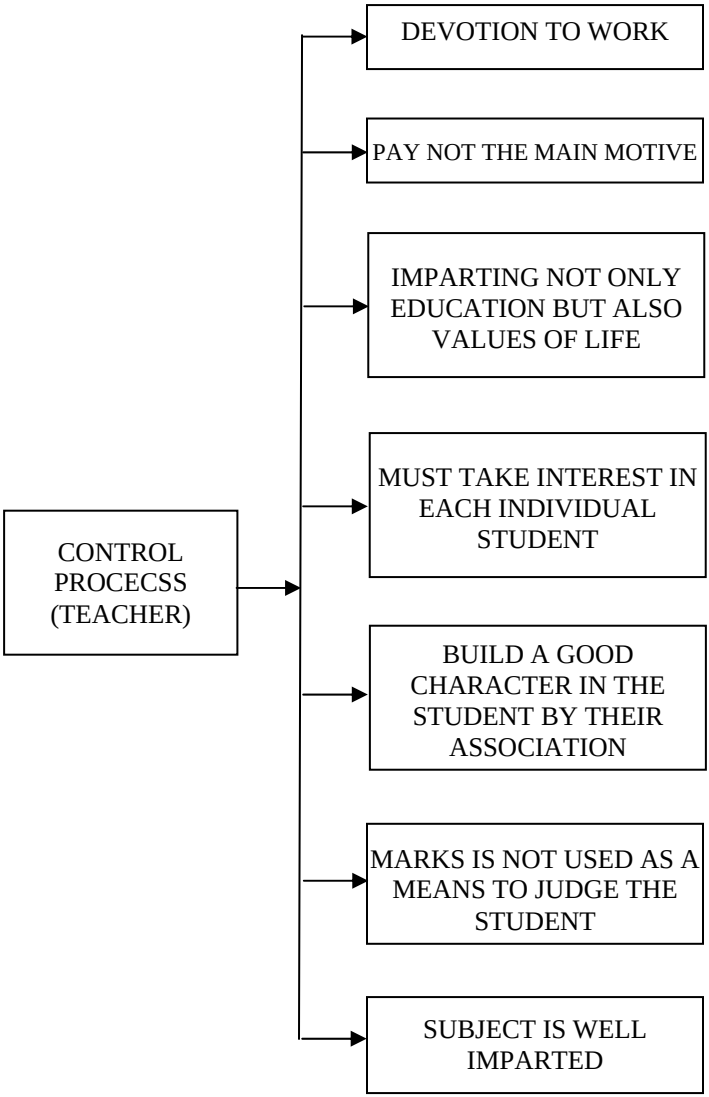

CONTROL PROCECSS (TEACHER)
DEVOTION TO WORK
PAY NOT THE MAIN MOTIVE
IMPARTING NOT ONLY EDUCATION BUT ALSO VALUES OF LIFE
MUST TAKE INTEREST IN EACH INDIVIDUAL STUDENT
BUILD A GOOD CHARACTER IN THE STUDENT BY THEIR ASSOCIATION
MARKS IS NOT USED AS A MEANS TO JUDGE THE STUDENT
SUBJECT IS WELL IMPARTED

Figure 3 Control Process (Teacher)

We have mainly used the qualities of a teacher to study the performance aspects of the students using Rule Based Control System (R.B.C.S.). The control system is the teacher and the controlled is the student. Using this our output is given as advantages or disadvantages or indeterminate.

We have not used the negative impact on the students by using a badly performed teacher (i.e., no devotion to work, subject is not well imparted pay is the main motive etc.) as a control system; since the Rule Base Control System (R.B.C.S.) works only in the ideal condition for the very word control is used in technical sense in machine and the aspects only as an ideal one. So only good qualities of a teacher is used when we apply it as a Control Process.

But the inputs are taken as both positive as well as negative qualities, since both are prevalent, the information, which we have, is very little, so the adaption of R.B.C.S. is valid.

From this study we see the performance aspects of school students and conclude that only under the good control process (ideal teacher), student can be made useful to the society. So only under the R.B.C.S. process, we can achieve this.

Without this process we cannot judge (as the data is meager) whether the student is useful to the society or not.

Thus when the selection of teachers are made it should be seen that they posses at least 90% of the qualities to be a teacher.

As the choice of good students cannot be made as we need to educate one and all, only the control, i.e., teacher should be selected in an ideal way, this alone can guarantee the best performance of the students.

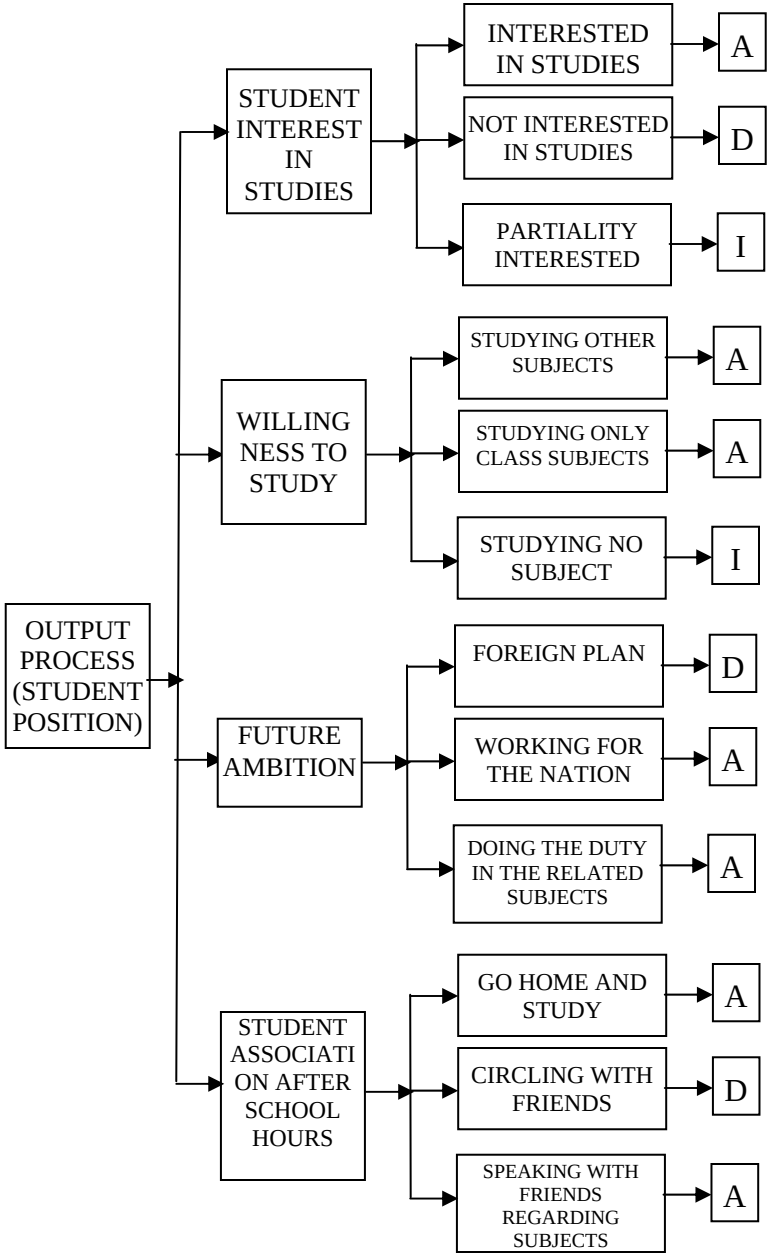

OUTPUT PROCESS (STUDENT POSITION)
STUDENT INTEREST IN STUDIES
INTERESTED IN STUDIES
A
NOT INTERESTED IN STUDIES
D
PARTIALITY INTERESTED
I
WILLING NESS TO STUDY
STUDYING OTHER SUBJECTS
A
STUDYING ONLY CLASS SUBJECTS
A
STUDYING NO SUBJECT
I
FUTURE AMBITION
FOREIGN PLAN
D
WORKING FOR THE NATION
A
DOING THE DUTY IN THE RELATED SUBJECTS
A
STUDENT ASSOCIATI ON AFTER SCHOOL HOURS
GO HOME AND STUDY
A
CIRCLING WITH FRIENDS
D
SPEAKING WITH FRIENDS REGARDING SUBJECTS
A

Figure 4

Thus the major findings from this study is that if the government must reduce the school dropout the teachers who are appointed for the teaching post must be not only devoted but also should have the capacity to motivate the students towards studies. This step will certainly decrease the school dropouts as it increases the performance aspects of the students.

Chapter Seven

MIGRATION OF PARENTS AND THE SCHOOL DROPOUTS A STUDY USING – THE FUZZY RELATIONAL MAPS MODEL

Though today's children are considered to be tomorrow's leaders of new and modern India, nothing is done to take care of the children who drop out of school for various reasons. There are many reasons as the stake holders in this case are children, parents and the government. We are not in a position to put the blame on the parents alone as they are in a way selfish and unconcerned about their children's education.

Most of the parents from very poor sections of the society are more worried about their day to day living and they do not even mind stopping the children from school if they can earn some daily wages for the family.

In this book we analyse the cause of such dropouts and here we mainly concentrate on the problems faced by the children at home and in the schools, the parents role in denying a child

even a primary education as they migrate from place to place in search of their livelihood and the apathy of the Public and the Government in response to this problem.

The main causes for the dropouts from schools are:

1. Poor economic condition of the parents.

2. No good school in the neighbourhood with least feasible fee structure.

3. Language problem in the school which curtails free and fearless communication.

4. Uneducated parents who are unaware of the value of education.

5. No proper counseling given to the poor and uneducated parents by the teachers or social workers about the need of the basic primary education and the unknown harm they are doing to their children by denying them education.

We use Linked Fuzzy Relational Maps (Linked FRM) to analyze this problem.

We suggest that education should be made free at least for the very poor in the school in the rural locality and in the towns and cities there must be schools with flexible admission systems and affordable fee structure and flexible rules of lack of attendance.

The least concerned issue of our nation is the dropouts in primary schools even though the latest constitutional amendment says that education is a fundamental right for children. As children are not the vote banks, no politician ever takes any interest about the dropouts in primary education, leave alone the children who have never joined or even visited school. The parents in a way are selfish and unconcerned about their

children's education, most of the parents in the very poor society are most bothered about their day to day living and they do not even mind stopping the child from school if the child can earn some daily wages.

In this book we analyse the cause of such dropouts and here we mainly concentrate on the public or on teachers, on the parents role in denying a child even a primary education and the Government's apathy to this grave problem. To achieve this we construct a Linked FRM model; as the data under analysis is an unsupervised one we felt only FRM can give us the hidden pattern of the situation.

The new notion called Fuzzy Relational Maps (FRMs) was introduced by Dr. W. B. Vasantha and Yasmin Sultana in the year 2000. In FRMs we divide the very causal associations into two disjoint units, like for example the relation between a teacher and a student or relation between an employee and an employer or a relation: between the parent and the children in the case of school dropouts and so on. In these situations we see that we can bring out the causal relations existing between an employee and employer or parent and child and so on.

Thus for us to define a FRM we need a domain space and a range space which are disjoint in the sense of concepts. We further assume no intermediate relations exists within the domain and the range space. The number of elements in the range space need not in general be equal to the number of elements in the domain space.

We now proceed onto define the new notion of linked FRMs.

Two FRMs represented by a relational matrix, say E_1 of order $m \times n$ and E_2 of order $n \times t$ can be linked to form a new relational matrix E of order $m \times t$. There may not be a direct relationship between the domain space of relational matrix E_1 and the range space of E_2 but certainly we could find out the hidden pattern in the Linked FRMs.

Use of Linked FRMs to study the case of Dropout children:

Let us consider, at the first stage, the relationship between the parent and the child who drop out of the school at primary level itself. Suppose the we take the domain space as the concepts belonging to the parent say P_1, …, P_8 and the range space denote the concepts belonging to the child say C_1, …, C_7.

We describe the nodes P_1, …, P_8 and C_1, …, C_7 in the following:

Domain space: Attributes related with parents are described in a line or two.

P_1 - Money is the main criteria. With their unsure, minimal income, a parent in rural area is not confident to plan for the future and unable to meet the needs in the present condition.

P_2 - Poverty and unable to pay a huge amount as school fee and spend money for uniform, textbooks, stationery, sports day, excursion etc.

P_3 - Importance and value of education not known or fully understood by the parents.

P_4 - Selfishness, as the parents want the children to earn even in its childhood level. Some children are forced to start working even while studying and finally quit studies.

P_5 - Family problem like permanent quarrel in the family due to drunkard father or broken families or illegal children or either of the parent runs away with some one and the unwanted children have no other way than to stay with them for survival.

P_6 - No proper earning member / income in the family to support the usual family expenses may be due to heavy loss in business or demise of a earning member or sudden failure in the market demands / agriculture failure.

P_7 - Hereditary job which someone has to continue at home.

P_8 - Frustration on the existing educational system and coaching imparted in the rural schools which lacks in basic minimum infrastructure and the least required number of qualified teachers and utter disregard for any kind of discipline and character formation.

Now we proceed onto describe the attributes related with children which is the range space is described in a line or two.

C_1 - Not properly motivated either by parents or by teachers to study and the value of education is not known at that age.

C_2 - Teachers are not good and often do not understand the childs' problem.

C_3 - No school with accommodating / affordable fee structure in the near by vicinity.

C_4 - Language and communication problem in the schools as in some cases the children are punished for speaking in their vernacular language and forced to communicate in English where in they do not feel confident to speak or communicate.

C_5 - Parents not educated enough to help the children at home in their studies.

C_6 - Laziness or bad company on the part of the children that leads to dropping out of school and run away to near by

cities where they end up as antisocial elements or child labourers or rag pickers and beggars.

C_7 - Looking after the younger children (ie., baby sitting), running errand and doing the household work by which they do not get enough time to sit and concentrate on studies.

C_8 - Prefer to be "free" and earn and live on their own than 'sit' and learn in the school.

The experts have selected a few of these attributes for their analysis and they were enumerated as the following:

P_1 - Poverty and lack of money to spare for children's education and hence they migrate to different place in search of lively hood and survival.

P_2 - Importance and the value of education not known / not properly understood.

P_3 - Family Problem.

P_4 - Hereditary job

P_5 - Frustration on the existing system of education in rural schools.

and those related with the children are as follows:

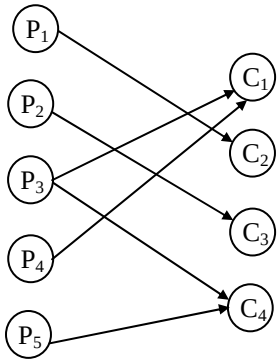
C_1 - Children not properly motivated

C_2 - No school with accommodating fee structure.

C_3 - Parents not educated enough to help the children

C_4 - Looking after the younger children and doing household work specially when the parents on move in search of job.

The relational directed graph of the parent - child model is as follows:



The connection matrix of the directed graph is as follows:

Let the relational matrix $E = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$.

Suppose A_1 = (1 0 0 0 0) i.e., Poverty causes dropouts in schools alone is in the on state.

To find the effect of A_1 on the dynamical system E.

$$A_1E = (1\ 0\ 0\ 0\ 0) \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = (0\ 1\ 0\ 0) = B_1$$

$$B_1E^T = (0\ 1\ 0\ 0)\begin{bmatrix}0&1&0&0\\0&0&1&0\\1&0&0&1\\1&0&0&0\\0&0&0&1\end{bmatrix} = (1\ 0\ 0\ 0) = A_1$$

$$A_1E = (1\ 0\ 0\ 0\ 0)\begin{bmatrix}0&1&0&0\\0&0&1&0\\1&0&0&1\\1&0&0&0\\0&0&0&1\end{bmatrix} = (0\ 1\ 0\ 0) = B_1$$

$$B_1E^T = (0\ 1\ 0\ 0)\begin{bmatrix}0&0&1&1&0\\1&0&0&0&0\\0&1&0&0&0\\0&0&1&0&1\end{bmatrix} = (1\ 0\ 0\ 0\ 0) = A_1.$$

Hence {(1 0 0 0 0), (0 1 0 0)} is the fixed point. This hidden pattern reveals that when poverty is the main problem on the part of the parents with regard to the education of their children and on the part of the children they leave the school as there is no school in the near by vicinity of their 'staying place' in which they could continue their studies and continue to pay the fee regularly.

Let us consider the relationship between the child who drop out of the school at primary level itself and the Government's role in this regard.

Suppose we take the domain space as the concepts belonging to the child say C_1, …, C_7 and the range space denote the concepts belonging to the Government say G_1, …, G_5.

We describe the nodes C_1, …, C_7 and G_1, …, G_5 in the following.

Attributes related with children which is the domain space is as follows:

C_1 - Children are not properly motivated by the parents and teachers.

C_2 - Teacher is not good and there are not sufficient number of teachers who could guide and coach the children; thus motivate them for their bright future.

C_3 - No school with accommodating fee structure.

C_4 - Language and communication problem as many schools insist on English and even punish the children who speak in the vernacular language.

C_5 - Parents are not educated enough to help the children at home.

C_6 - Laziness or bad company on the part of the children.

C_7 - Looking after the younger children and doing household work specially when the parents on move in search of job.

We describe the attributes related with the government which forms the range space of the FRMs model.

G_1 - Government has not provided good schools with moderate fee structure in the near by vicinity of every village.

G_2 - No proper road and transport facilities available the school children to reach the school.

G_3 - There are not adequate number of well trained teachers to take care of the children.

G_4 - Poor parents who depend on the small income of their children's daily labour are not adequately taken care by the government to motivate them to send the children to school

G_5 - There is no provision in the existing school system for the migrating children to continue their studies in other schools. Government run Central Schools with the CBSC syllabus has provision for any student to get admission at any time of the year as their parents could get transferred from place to place which by no means apply to the poor migrant labourers. This facility is not available for the migrant poor, uneducated parents.

To make the calculation easy we take the domain and range space as follows:

The domain attributes chosen by the expert is as follows:

C_1 - Children are not properly motivated by the parents and teachers.

C_2 - No good suitable school with accommodating fee structure and flexible rules.

C_3 - Parents not educated enough to help the children.

C_4 - Looking after the younger children and doing household work specially when the parents on move in search of job.

The attributes related with range space is as follows:

G_1 - Government has not provided good schools with moderate fee structure in the near by vicinity of every village.

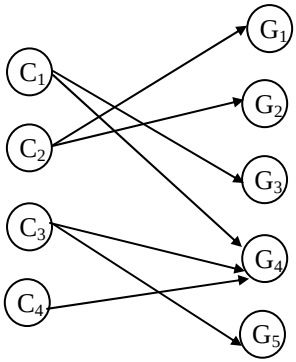
G_2 - No proper road and transport facilities available the school children.

G_3 - There are not adequate number of well trained teachers to take care of the children.

G_4 - Poor parents who depend on the small income of their children's daily labour are not adequately taken care by the government to motivate them to send the children to school.

G_5 - The existing government schools should have flexible rules and suitable fee structure to accommodate the migrating children in their schools.

The relational graph of the Child - Government model is as follows:



Let the relational matrix E = $\begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \end{array} \begin{array}{c} \begin{array}{ccccc} G_1 & G_2 & G_3 & G_4 & G_5 \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$.

Suppose A_2 = (0 1 0 0) i.e., no good school with accommodating fee structure. To find the effect of A_2 on the dynamical system E.

$$A_2E = (0\ 1\ 0\ 0)\begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} = (1\ 1\ 0\ 0\ 0) = B_2$$

$$B_2E^T = (1\ 1\ 0\ 0\ 0)\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} = (0\ 2\ 0\ 0) \hookrightarrow (0\ 1\ 0\ 0) = A_2$$

We see it is a fixed pair {(1 1 0 0 0), (0 1 0 0)} and government is not provided with moderate fee structure and no proper road and transport facilities.

Now we find the effect of the on state of parents not educated enough to help the children.

Let A = (0 0 1 0) to find the effect of A on E.

$$AE_1 = (0\ 0\ 1\ 0) = \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} = (0\ 0\ 0\ 1\ 1) = B_1$$

$$B_1 E_1^T = (0\ 0\ 0\ 1\ 1) \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= (1\ 0\ 2\ 1) \hookrightarrow (1\ 0\ 1\ 1) = A_1 \text{ (say)}$$

$$\text{We find } A_1E = (1\ 0\ 1\ 1) \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= (0\ 0\ 1\ 3\ 1) \hookrightarrow (0\ 0\ 1\ 1\ 1) = B_2.$$

$$B_2\ E_1^T = (0\ 0\ 1\ 1\ 1) \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} = (2\ 0\ 2\ 1) \hookrightarrow (1\ 0\ 1\ 1) = A_2$$

$$A_2E_1 = (1\ 0\ 1\ 1) \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= (0\ 0\ 1\ 3\ 1) \hookrightarrow (0\ 0\ 1\ 1\ 1) = B_3.$$

Thus we arrive at the fixed point {(1 0 1 1), (0 0 1 1 1)} which reveals that when there are not adequate well trained teachers to motivate the children and the parents and there is no provision to look after the younger babies in villages i.e., along with the schools the government could think of “crèche” for the

village kids and there could be a evening tuition class at every village, not by the same school teachers, for the children to study and do their home work. The existing government schools in towns and cities should have flexible rules and suitable fee structure to accommodate the migrating children in their schools.

Use of Linked FRMs to study the problems of school dropouts and migrant parents.

The existing relationship between the parents who children are dropouts and the role of the government cannot be easily related for we see that there is no direct relationship existing between the two; but certainly a hidden relationship must exist for dropout from schools and the child labour is flourishing while the government remaining a passive on looker.

So in order to find the relation between these two, i.e., parents and government, we use a newly founded technique called Linked Fuzzy Relational Matrix (LFRM)

Using the relational matrices relating the parents and the child and that which relating the child and the government, we obtain the parent and government's linked relational matrix.

We have the following relational matrices parent × child and child × government we get the following relational matrix between parent × government, $E \times E_1$.

$$= \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} = E_2 \text{ (say).}$$

Consider the state vector $A_1 = (1\ 0\ 0\ 0\ 1)$.

To find the effect of A_1 on the linked Fuzzy Relational matrix E_2.

$$A_1 E_2 = (1\ 0\ 0\ 0\ 1) \times \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} = (1\ 1\ 0\ 1\ 0\ ) = B_1 \text{ (say)}$$

$$B_1 E_2^t = (1\ 1\ 0\ 1\ 0) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$= (2\ 1\ 1\ 1\ 1) \hookrightarrow (1\ 1\ 1\ 1\ 1) = A_2 \text{ (say)}$$

$$A_2 E_2 = (1\ 1\ 1\ 1\ 1) \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= (1\ 1\ 2\ 4\ 1) \hookrightarrow (1\ 1\ 1\ 1\ 1) = B_2 \text{ (say)}$$

$$B_2 E_2^T = (1\ 1\ 1\ 1\ 1) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$= (2\ 2\ 2\ 2\ 1) \hookrightarrow (1\ 1\ 1\ 1\ 1) = A_3 \text{ (say)}$$

$$A_3 E_2 = (1\ 1\ 1\ 1\ 1) \times \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= (1\ 1\ 2\ 4\ 1) \hookrightarrow (1\ 1\ 1\ 1\ 1) = B_3 \text{ (say)}$$

$$B_3 E^T = (1\ 1\ 1\ 1\ 1) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

$$= (2\ 2\ 2\ 2\ 1) \hookrightarrow (1\ 1\ 1\ 1\ 1) = A_4 (= A_3)$$

Thus the hidden pattern is {(1 1 1 1 1), (1 1 1 1 1)}.

A single attribute does not in general affect parents or the child's life but we see that all the attributes certainly has a drastic effect on the totality of the system i.e., when we take the nodes P_1 and P_4 in the ON state all the nodes in the range space come to ON state i.e., government policies are at its worst and something has to be done at once on war footing.

The parents and their expectations from the part of the government are all justified and government has a lot to do in terms of improving the educational status and thus the number of school dropouts every year which will surely lead to the reduction in the number of child labourers.

Further all the nodes come to on state from the side of the parents also. Further this new model alone has the capacity to interlink the parents attributes with the government.

Here we give the conclusions and suggestions made from our study.

- We observe that when the parents are not in a position to pay the fee in large amount and when their hereditary job requires them at the agricultural fields or due to monsoon failure, if they migrate to towns and cities in search of job and survival, it is the government which has to take all the necessary steps to retain the children in the school itself by providing complete free education and even stipends for the children of very poor parents or destitute.

- Government has to provide good schools with moderate fee structure within a reachable distance for every child in every village or can fix a fee limit in the existing matriculation schools thus curbing many schools from solely running with a profit motive.

- It is high time that the government thinks of a alternative system of education or schools where in the children of migrating parents could continue with their education.

- Government has to improve the road and transport facilities between villages and the school centers in the rural areas. There should be

free pass or tickets at concessional rates for every school going child.

- Government should appoint adequate number of well trained teachers in all the rural schools. The basic problems of the teaching community must be attended to and their difficulties in teaching in a private school must be sorted out.

- Main concentration on the part of the government should be on the rural compulsory school education so that each village get its best and standardized education at their door step with less cost.

- If the migration of parents could be stopped it is better. If not at least the children must be made to study in the villages itself. This can be done by building a nice hostel attached with the school to accommodate the children of parents who migrate fro their livelihood. There in many problems related with migration will be settled at the village itself and thus many men and women could be saved from many communicable diseases and many social disorders could be settled at the beginning stage itself.

We conclude that the school dropout problem is increasing in an alarming rate and if something is not done with long term objective and short term activities, the problem will go out of control. For this the government, Parents and the children have to join hands to gather along with the good hearted public and NGOs to see that no child leaves the school with out proper growth and skill development.

Chapter Eight

THE IMPACT OF MISSIONARY INTERVENTIONS ON THE EDUCATION AND REHABILITATION OF DEPRIVED CHILDREN – A FUZZY ANALYSIS

We have seen the school dropouts and their life after. If these students who are lucky to find themselves in the rehabilitation homes what best can be done. Several socio scientists, educationalists, reformer and public all of them felt if the rehabilitation work is carried out by missionaries like fathers in case of boys and sisters in case of girls the output would be better.

One of the major human rights problem is the status of the deprived children and their education and rehabilitation. But to one's surprise, as the children are not vote banks the government has not taken any steps to rehabilitate them or even help them in any manner. But as today's children happen to be tomorrows policy makers and rulers of the nation, it is very important that these deprived children from the deprived classes who form over 50% of the nation's population, must be

rehabilitated. Government has failed to support them to the best of our knowledge. We see the Missionaries have helped these children both in the past and at present to a very great extent.

We study the impact of Missionary interventions on the education and rehabilitation of deprived children using Fuzzy theory in general and Fuzzy Cognitive Maps (FCMs) in particular. Since the data under consideration happens to be an unsupervised one we are justified in using FCMs to analyze the problem.

Here we describe the problem of the deprived children.

The term "Deprived Children" in this book denotes those who are child labourers / orphans / very poor children / runaway children / children of the depressed castes or classes / children of alcoholic parents / children whose parents are in prison. At large, these children are found destitute and on the streets, or in places like railway stations, and other urban areas where they struggle for their livelihood - which often involves begging, carrying sundry errands, rag-packing or some other 'menial' job.

Here we analyze the impact of missionary interventions on the rehabilitation of these children. A linguistic questionnaire was prepared and based on it, we have taken 12 attributes related to these children and the missionaries. The linguistic questionnaire was transformed into a Fuzzy Cognitive Maps (FCMs) model with these 12 main attributes as nodes.

1. Except for the support, love and affection (education, economic, as well as vocational training) extended by the missionaries, several of these deprived children would have perished in the same socio and economic condition.

2. The social outcasts would be in greater numbers but for the successful interventions carried out by the missionary groups by instilling the value of life in the hearts and minds of deprived children.

3. The gap between the educated caste - Hindus and educated deprived classes would have been still wider, with the rich becoming richer and the poor being further exploited with no respect for human dignity.

4. Several children in these rehabilitation homes felt that they were not only happy with food, shelter, clothing and education but they also felt that here they were free from insults like untouchability, ill-treatment and harassment. Just by a simple fact like uniformity in dress, plates and food, they could experience a greater degree of equality among them.

5. It could be gathered from our interviews, that owing to the contribution of the missionaries, large number of children were rehabilitated into a more secure world where they wouldn't become victims of exploitative people or turn into anti-social elements themselves. They have learnt the value of labour.

6. Apart from being happy for the literacy and vocational training that was imparted to them, they also mentioned that the atmosphere in these mission run homes was free from casteist discriminations which had earlier been a major barrier in their lives.

7. Existence of no free school in their locality and the inability of their parents or care takers to pay the school fee and other requirements, has forced the deprived children's education and formal training to stop abruptly at an early stage itself.

8. In some cases fear of education and the strictness in the school system have lead the deprived children to dislike school education and drop out of the normal life pattern.

9. Also bad company and influence of children who are already on the wrong path in their life and who "some how" lead their life on their own diverted the motivation of deprived children to choose any means to earn their living.

10. The atmosphere in their living places lead them to a level of dejected state of mind due to parental quarrel, alcoholic and drug addicted parents, parents in prison and parents being rowdies or social outcasts.

11. Missionaries are motivators of values in life instilled the need for disciplined life in their hearts and minds and the importance of skilled training and knowledge to improve one's life (A good number of teachers of the past and present have been educated in the Missionary run institutions).

12. Missionaries as 'rehabilitators' also have provided job/food/skilled training even to the parents and care takers of deprived children.

We just give the main nodes C_1, C_2, …, C_{12} and describe them in a line or two.

C_1 : Support, love and affection shown by the Missionaries.

C_2 : Lesser in number of social outcastes due to intervention of Missionaries.

C_3 : Gap between the rich and deprived class reduced.

C_4 : Experience of equality in Boarding and Schools run by missionaries.

C_5 : Large number of children saved from exploitative groups.

C_6 : Absence of caste discrimination in mission run homes.

C_7 : No free school within their locality.

C_8 : Fear and strictness in the educational system lead to drop out of school.

C_9 : Bad company and influence of other children spoiled their future.

C_{10} : Atmosphere at living place not conducive for study and growth.

C_{11} : Missionaries motivated and instilled hope and discipline in life.

C_{12} : Missionaries provided job and skilled training for children and even care takers.

We analyse the problem using FCMs.

As the data is an unsupervised one and involves lot of uncertainties we are justified in using FCMs to analyze the problem.

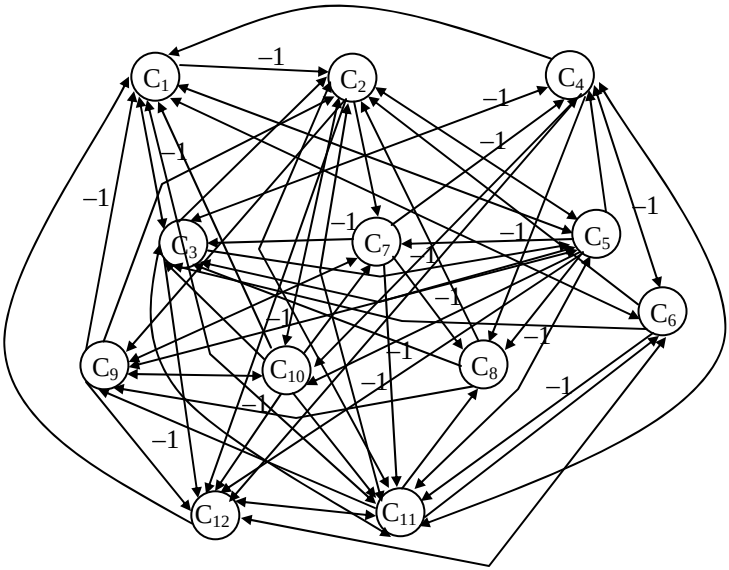
Here we give the opinion from three experts : One is an alumini of a deprived children's home run by a Jesuit priest. He was a rag picker in the street and later grew up in the boarding home.

Our second expert is an NGO, who has been involved in this kind of service for the past twenty years to the children of less privileged. Third expert is a college Professor who is kind hearted and is a good social analyst.

First expert's opinion given as the directed graph has been converted into a connection matrix.

This 12×12 matrix M_1 that represents the Impact of Missionary Interventions on the Education and Rehabilitation of Deprived Children.

The directed graph given by the first expert is as follows:



$$M_1 = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \\ C_7 \\ C_8 \\ C_9 \\ C_{10} \\ C_{11} \\ C_{12} \end{array} \begin{array}{c} \begin{array}{cccccccccccc} C_1 & C_2 & C_3 & C_4 & C_5 & C_6 & C_7 & C_8 & C_9 & C_{10} & C_{11} & C_{12} \end{array} \\ \begin{bmatrix} 0 & -1 & -1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & -1 & 1 & 1 & -1 \\ 1 & -1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & -1 & 1 & 1 \\ 1 & 0 & -1 & 0 & 0 & 1 & 0 & -1 & 0 & -1 & 1 & 1 \\ -1 & 1 & 1 & -1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & -1 & -1 & -1 & 0 & 0 & -1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & -1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & -1 & 0 & 1 & -1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & -1 & 0 & 0 & -1 & -1 & 1 & 0 \end{bmatrix} \end{array}$$

Let us start with the support, love and affection shown by the Missionaries to improve the socio, economic condition of

the deprived children as the initializing vector C_1 i.e., C_1 is in the ON state and all other attributers are in OFF state.

C_1 = (1 0 0 0 0 0 0 0 0 0 0 0)

C_1M_1 = (0 –1 –1 0 1 1 0 0 0 0 1 0)

$\hookrightarrow$ (1 0 0 0 1 1 0 0 0 0 1 0) = C_2

('$\hookrightarrow$' denotes the resultant has been thresholded and updated)

C_2M_1 $\hookrightarrow$ (1 1 1 1 1 0 0 1 0 1 1 1) = C_3 (say)

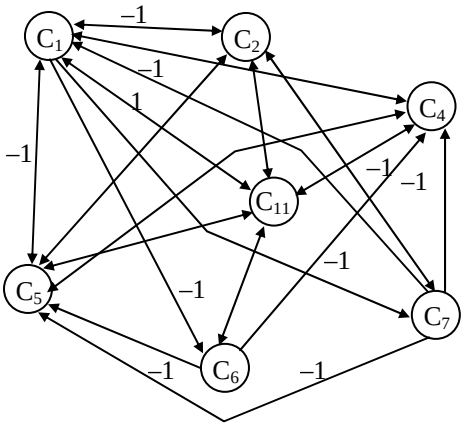
C_3M_1 $\hookrightarrow$ (1 1 1 1 1 0 0 1 0 1 1 1) = C_4 (say).

Thus we see the hidden pattern is a fixed point given by (1 1 1 1 1 0 0 1 0 1 1 1).

From this we conclude that the Missionaries by their support, love and affection for the deprived children, (C_2) decreases the number of social outcastes; (C_3) reduce the gap between the rich and deprived classes; (C_4) increase the joy, happiness in the children not only with the food and education they provided but by treating them equal with others; (C_5) block the process of children getting into the clutches of the exploitative gangs like thieves, rowdies and outlaws; also (C_8) the children have experienced certain amount of strictness in the school life atmosphere for study is condusive not for growth C_{10} (that is home is not for any growth) and (C_{11}) the level of motivation and confidence in life have increased due to the intervention of the Missionaries. Finally the Missionaries have provided training and job not only to the children but also their parents and care takers.

Consider another Expert's opinion who feels only the attributes C_1 C_2 C_4 C_5 C_6 C_7 C_{11} are relevant.

Using the directed graph given by the expert given below we find the connection matrix M_2.



Using his opinion we get a 7×7 matrix M_2.

$$M_2 = \begin{array}{c} \\ C_1 \\ C_2 \\ C_4 \\ C_5 \\ C_6 \\ C_7 \\ C_{11} \end{array} \begin{array}{c} \begin{array}{ccccccc} C_1 & C_2 & C_4 & C_5 & C_6 & C_7 & C_{11} \end{array} \\ \begin{bmatrix} 0 & -1 & 1 & -1 & 1 & -1 & 1 \\ -1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & -1 & 0 & 0 & 1 \\ -1 & 1 & -1 & 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & -1 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

Let us start with the same vector C_1 to be the only vector in the ON state i.e., the support given by the Missionaries to improve the socio, economic condition of the deprived children as the initializing vector C_1.

The effect of $C_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0)$ on M_2 is given by

$C_1M_2 = (0\ -1\ 1\ -1\ 1\ -1\ 1) \hookrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1) = C_2$ (say)

$C_2M_2 \hookrightarrow (1\ 1\ 1\ 0\ 0\ 0\ 1) = C_3$ (say)

$C_3M_2 \hookrightarrow (1\ 0\ 1\ 0\ 0\ 0\ 1) = C_4$ (say)

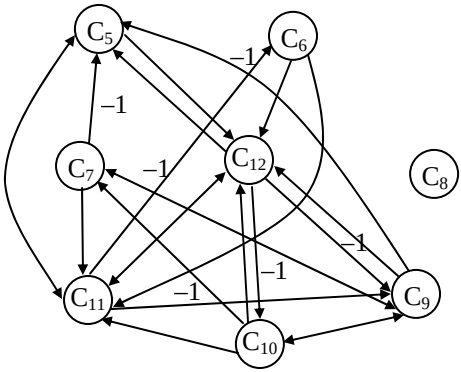
$C_4M_2 \hookrightarrow (1\ 0\ 1\ 0\ 0\ 0\ 1) = C_2$ (say)

The resultant is a the limit cycle that $C_1 \Rightarrow C_2 \Rightarrow C_3 \Rightarrow C_4 \Rightarrow C_2$ and is given by the vector (1 0 1 0 0 0 1) which implies that (C_1, C_4, C_6, C_{11}) are in ON state.

We interpret this result as follows:

When the support, love and affection by the Missionaries for the deprived children increases. (C_4) the Children's experience of being treated equal in the school and boarding makes them happier than before. They clearly expressed (C_6) the absence of caste discrimination in the Mission run schools and homes. Finally the (C_{11}) level of motivation and confidence in life have increased due to the intervention of the Missionaries.

Consider the third Expert's opinion who has only selected the relevant attributes as C_5 C_6 C_7 C_8 C_9 C_{10} C_{11} and C_{12}. The directed graph given by the expert is as follows:



The related connection matrix M_3 is as follows:

Let us denote it by another 8×8 matrix M_3.

$$M_3 = \begin{array}{c} \\ C_5 \\ C_6 \\ C_7 \\ C_8 \\ C_9 \\ C_{10} \\ C_{11} \\ C_{12} \end{array} \begin{array}{c} \begin{array}{cccccccc} C_5 & C_6 & C_7 & C_8 & C_9 & C_{10} & C_{11} & C_{12} \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ -1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & -1 & 0 & 1 & 0 & 1 & 1 \\ 1 & -1 & 0 & 0 & -1 & 0 & 0 & 1 \\ 1 & -1 & 0 & 0 & -1 & -1 & 1 & 0 \end{bmatrix} \end{array}.$$

Let us start with the vector C_{11} which means the motivation, inspiration in life by their words and deeds and the sense of discipline instilled in the hearts and minds of the deprived children as the initializing vector C_1.

$C_1 = (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$

$C_1M_3 = (1\ -1\ 0\ 0\ -1\ 0\ 0\ 1) \hookrightarrow (1\ 0\ 0\ 0\ 0\ 0\ 1\ 1) = C_2$

$C_2M_3 = \hookrightarrow (1\ 0\ 0\ 0\ 0\ 0\ 1\ 1) = C_3.$

So C_2 is the fixed point which implies that $\{C_5, C_{11}, C_{12}\}$ are in ON state.

This result strongly brings out the effects of motivations and sense of discipline among the deprived children. (C_5) The children have learnt the value of labour and thus have not become the puppets in the hands of the exploitative gangs not did they turn out to be such a person (C_{12}). The missionaries have paved a way for an all round growth and provided skilled training and livelihood for them and their families too.

We add all these three matrices M_1, M_2 and M_3 to get the combined FCM which also represents a simple form of causal learning.

$$M = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \\ C_7 \\ C_8 \\ C_9 \\ C_{10} \\ C_{11} \\ C_{12} \end{array} \begin{array}{c} \begin{array}{cccccccccccc} C_1 & C_2 & C_3 & C_4 & C_5 & C_6 & C_7 & C_8 & C_9 & C_{10} & C_{11} & C_{12} \end{array} \\ \begin{bmatrix} 0 & -2 & -1 & 1 & 0 & 2 & -1 & 0 & 0 & 0 & 3 & 2 \\ -1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & -1 & 1 & 3 & 1 \\ 1 & -1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & -1 & 1 & 1 \\ 2 & 0 & -1 & 0 & -1 & 1 & 0 & -1 & 0 & -1 & 2 & 0 \\ -2 & 2 & 1 & -2 & 0 & 0 & 0 & 2 & 0 & 1 & 3 & 3 \\ 0 & 2 & 1 & 2 & 0 & 0 & 0 & 0 & 0 & 0 & 3 & 2 \\ 0 & 0 & -1 & -2 & -3 & 0 & 0 & -2 & 2 & 0 & 3 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 & 2 & 0 & 2 & 0 & 0 & 2 & 0 & 2 \\ 1 & 1 & 1 & 1 & 0 & 0 & -2 & 0 & 2 & 0 & 2 & 2 \\ 2 & 2 & 1 & 0 & 1 & -2 & 0 & 1 & -2 & 0 & 1 & 2 \\ 1 & 1 & 1 & 1 & 2 & -2 & 0 & 0 & -2 & -2 & 2 & 0 \end{bmatrix} \end{array}$$

For the matrix M we apply the vector C_1 once again

$C_1 = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$

$C_1M = (0\ -2\ -1\ 1\ 0\ 2\ -1\ 0\ 0\ 0\ 3\ 2)$

$\hookrightarrow (1\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 1\ 1) = C_2$

$C_2M = (5\ 3\ 1\ 4\ 2\ -1\ -1\ -\ 0\ 4\ -3\ 11\ 7)$

$\hookrightarrow (1\ 1\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1) = C_3$

$C_3\ M = (3\ 2\ 1\ 1\ 4\ -1\ -1\ 2\ -5\ -2\ 15\ 10)$

$\hookrightarrow (1\ 1\ 1\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 1) = C_4.$

$C_4M = (3\ 3\ 2\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1)$

$\hookrightarrow (1\ 1\ 1\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 1) = C_5$ (say) $= C_4.$

Thus the hidden pattern is a fixed point which reveals the ON state vectors as

$\{C_1, C_2, C_3, C_4, C_5, C_8, C_{11}, C_{12}\}.$

From this we conclude that the Missionaries by their support, love and affection for the deprived children (C_2) decreases the number of social outcasts; (C_3) reduce the gap between the rich and deprived classes; (C_4) increase the joy happiness in the children not only with the food and education but by treating them equal with others; (C_5) block the process of children getting into the clutches of the exploitative gangs like thieves, rowdies and outlaws and (C_5) the level of motivation and confidence in life have increases due to the intervention of the Missionaries.

C_8 denotes the strictness leads to more dropouts in schools. C_{11}-missionaries motivated and instilled hope and discipline in life and C_{12} missionaries provided job and skilled training for children and even caretakers.

Our major conclusion is that except for the intervention of Missionaries the life of the deprived children would have been miserable and 90% of the experts felt certainly that the Missionaries have narrowed the gap between the caste Hindus and the deprived class of people.

Several social reforms have taken place silently for otherwise these children would have turned into antiosocial elements. The missionaries have induced in these children value and meaning in life.

Also 93% of the experts agreed that they live a dignified life in comparison with other Hindu Dalits who are denied basic human respect and dignity. In fact the result which says that the decrease in drop outs from Missionaries run schools reveals that they are lucky to have come in contact with the Missionaries or schools run by their successors.

Over 85% of the experts felt that not only the Missionaries have rehabilitated them alone but have rehabilitated their entire family.

Surprisingly all our conclusions are substantiated as the data given in the book titled “Born again Jesuits back in Tamil Nadu” edited by Dr. Leonard Fernando and Dr. Bernand D’Sami. [6].

Chapter Nine

CONCLUSIONS AND SUGGESTIONS

The following conclusions and suggestions are given from the discussions with educationalists teachers and students. Most of the mathematical conclusions are given then and their in the respective chapters. However the first part gives about school dropouts who are female children. As it cannot come under a general study we have mentioned only few facts about them for a separate study has to be carried out which is beyond the scope of this book.

In this chapter we just study the problems of female children in India. Mostly we analyse the problems of poor or very poor or middle class or lower middle class female children in India at large and Tamil Nadu in particular.

The problems faced by female children in India is very unique. It cannot be even put under the heads of school drop outs or run away children. The two special broad heads under which their problems can be considered are as follows:

(1) Female children who have never entered the school premises.

(2) School dropouts.

In case of female children who have never entered the school premises fall under these heads:

(a) Small girls who are abducted for flesh trade even when they are less than two years.

(b) Missing girls in a very young age

(c) Born in very poor family with conservativeness where girls are never sent out.

(d) Born in families like Bachhara where the young girls as used for prostitution to earn for the family.

(e) In some male dominated families from poor, very poor or middle class strata the female children are never educated only trained in house hold work. So from the age of five they start to work, doing all house hold core like fetching water from well, cleaning vessels, washing cloths, sweeping the house and maintaining the house and so on.

The category of children have never stepped the school premises. In some poor and very poor families these children are sent to work in other houses all these house hold work. From the age of five years till they die they do only house hold work. They do not know the joys of childhood days. They are born to work and work only. Is that any way justifiable? Who can give voice to them? If by chance their husband dies they suffer humiliations and social stigma but continue to do the house hold work.

Can there be any other nation in the world which treats female children and women as bad as India?

They are denied the pleasure of playing at a young age, learning at a young age from birth to death they toil for the male

dominated society? Is it liberation? Are men themselves liberated in their thinking? These are dire truth, which is never spoken of or heard of. Those who talk of women's rights or feminism are blind to these. They cannot go far if they take up these issues for the reason best known to them. Thus these children are not only deprived education but also the right to enjoy their life of childhood days.

These girls take up the family responsibility in a age as young as 3 to 4 years, like looking after the younger siblings and so on. Another group are the abducted or missing children. Without shame each citizen of India read the report from Times of India which speaks of "27% spike in procurement of minor girls", "what is a positive action taken to prevent it?" Female children are sold for Rs. 10,000 to Rs. 30,000 for flesh trade! Why no one takes up the issue? Are we so absorbed in our day to day routine? Have we lost our social awareness? We exist for others and live our life to the fullest!

These girls do not have a life after for their life after is some chronic ailment like STD or HIV/AIDS dying in loneliness in the prime of their age say between 30 to 50 years.

Who is to be blamed? Their life is a drudgery or a life of shame in the society for the nation holds a social stigma for prostitutes. The very words is used by Indians as for scolding a women! So why are these young girls who do not know any thing are sold or abducted. Is India a male dominated nation? What is the plight of such missing, abducted and sold female children?

Also female children become school dropouts as they are married at a very young age and so forced to drop out of school. Such dropouts can never be saved. Further most of these marriages are done to men who are four times (or more than) the age of the girl who in most cases happens to be their relative. In India it is a custom that if the husband dies the girl however young she may be cannot marry again. Further the very sight of widows is inauspicious and they are prohibited

from attending any auspicious functions for they are bad omen to others.

Even today such barbarious meaningless superstitions are practiced in India. Before and even today in some places when the husband dies the wife is burnt alive in the pyre of her husband. Only in the British rule this practice of Sathi (Sati) was abolished only on paper but even today it continues in several places in rural India and remains unreported. For media functions only for the privileged and popular people and elite society. Very rarely cases of such types come in print media unless some powerful person is involved.

Now we proceed on to give the conclusions and suggestions based on our study.

(1) to prevent the school drop out from very poor and poor some incentive must be paid to the parents (monthly) after meeting the parents and educating them of the importance of education and informing them that if they force their children be it male / female as a child labourer they would be punished.

If parents are counseled properly certainly it will stop the number of school dropouts.

Further because of the monthly incentive (money) they get by educating their child they will also encourage their children to go to school.

Books, note books, other stationeries and fees must be fully free for them, apart from the incentive paid monthly to their parents for educating their children.

Every village must have a higher secondary government school with fullfledged staff and a three member committee must be employed by the government termed as educational officers who regularly monitor the school functioning and assess the school drop out as well as hold parents - teachers meeting monthly with all the parents of the villages (class wise

if the village is large) spend three hours provide them free lunch or dinner and ministers or chief minister should address them at least once in the year. Further these three officers should provide for the students after school hours free tuitions and help them in their studies.

(2) Means and methods to make the class room an interesting place and not a prison. Teacher must be given special training and coaching programme not only on the subjects taught but also how to handle the students so that school dropouts do not occur and students are motivated to come to school regularly.

(3) A complete revision of curriculum of classes from I to XII is to be made by the government.
The taste of school education is a boredom only assess the students on memory. The most capable topper is the one with most mugging up capacity.

(5) Curriculum do not make the real intelligent students come up with flying marks.

(6) To prevent school dropout new methods should be evolved so that after say 10 years i.e., after fifth standard students interest are found and accordingly higher education that is class VI to XII is given. For instance if a student shows interest in music he is put in that stream with more emphasizes on music lessons, so for art, drawing or for 'mathematics' or for interest in handicrafts and so on.

(7) every day at least 45 minutes must be spent in every class by a well equipped teachers who have the talent to react, council and make free the minds of these children and at the same time teach them the values of life and above all service to fellow men and service to the nation to make it a better place for one and all. So that students are not self centered and only think all the time of their self.

Secondly the school dropouts who are runaways are offended deeply but momentary so with no reason or rhyme

they just run away from their homes to shun school atmosphere, in some cases to shun the home atmosphere they drop out from school and ultimately land as beggers, rag pickers staying in platforms or bus stands or working as cleaners in lorry sheds or cleaners in hotels and so on.

If at all these children had some emotional training trying to reason out, patience, tolerance, values of life, adjustments, mind to see and analyse the perspective of others. They would by no means runaway from home. These children are very egoistic, self centered and independent thinkers; their energy and mind should be trained in a very different way. Any word of offence may make them not only school dropouts runaway as well as at times they may seek the extreme step of ending their lifes.

If these children enjoyed better education in schools were comfortable and can freely discuss their problem both with the teachers as well as with parents certainly such school dropout and runaway will not occur. Certainly they will strike a balance and continue their studies and stay at home.

Thus the study strongly revealed that there is something lacking in our school education system which does not teach the students to be selfless, patient (tolerance towards other), think of others (parents, teachers fellow classmates) but on the other hand our education has made children self centered with ego (which can be easily hurt for no solid reason or false ego, ego not a match to their status).

Only when a real education which teaches them tolerance, patience, selflessness, pain of others with no ego or self centeredness than alone such school dropouts and runaways will not occur. So first the political leaders educationalists, teachers and authorities who run the schools must select not only teachers who are devoted to the profession but also take up this profession for the very noble cause and not just for money.

It is learnt with despair several of the government school children said teachers never come to class even if they come to

class they do not teach, give work to students like cutting vegetables, running errands, fetching water to their homes, giving water to their cattle and so on.

They just provide before the exams the books so that they can copy from it. Practically in most government run schools no teaching is done. The teachers spend some time gossiping about their family with other teachers, eat the noon meal with egg provided for the children and go home.

Government must periodically and surprisingly make visit to inspect the school functioning and suspend the teachers who are not in the class and teaching the students. Unless such stern actions are taken it would be impossible to make the government teachers teach their students. This is one of the main reasons why students do not know subtraction, cannot even read headlines in tamil and so on. It is reported by students and parents no teacher ever teaches any thing to the students. This is the state of affairs in case of most of the rural government schools.

It is observed from our study student progress of life depends only on good teachers. Only a good teacher can mould the basic nature of the students and make them continue their studies and not become dropouts.

If the teachers are kind, devoted, understanding and motivates them we can certainly stop those school dropouts who leave school due to the boredom of studies. However nothing can be said about school dropout due to family problems. Also school dropouts due to abduction or missing cannot be improved unless the society changes and values the children as human and are to be fondled but not abducted, made to labour and die before age.

There is no scope to save school dropouts whose parents send them for petty jobs due to poverty.

At this stage it is suggested government takes care of these children and educate them and at the same time pay the poor parents some money to sustain themselves or give employment to their parents.

Another problem faced by children (mostly female) in the homes run by some of the NGO's is that these children are not given education but sexually misused and supplied to police and other rich customers for money.

When will this situation be changed? First the police and the public should be corrected for abduction and misusing these young girls for sex. However the judiciary should do justice, in a short period this is one of the major defects of courts. For it is recalled with desperation "Justice delayed is justice denied". So the court should pass on the verdict say with in a maximum period of three months and the police and public should help in doing this. For abduction, missing and selling of children is a very heinous and a worst crime and the punishment must be severe and rendered in a very short period.

Abduction and selling of female children should be pronounced as a crime for which death penality is the punishment.

Female child tracking must be punished. Child marriage, that is marrying girls to 4 to 5 times older men must be stopped if really one as to work for minimizing school dropouts and make children enjoy their childhood.

Teachers must be specially trained by the government so that they handle the children with care. It is a pity and pain to state that government school teachers do not teach the children they misuse them for petty errands. Such teachers who form the majority in rural government schools should be punished or sent out of job. Unless government takes special and stern steps in this direction it is impossible to stop school dropouts.

However in case of private schools, teachers cannot act in the way government school teachers do for the private school management sees to that the teachers take classes and do teach well.

Government should not appoint teachers on permanent basic only on contract basis. Further inspection in rural government school should be made by government representatives and teachers and those who do not take classes and are not punctual must be dismissed on the spot.

Only such punishment can make them do their work seriously with devotion for which they are paid.

Unless teachers are councilled about the importance of their noble profession, school dropouts cannot be stopped.

Special laws to punish the persons who practice child labour must be formulated.

It is reported in Times of India on Dec. 26, 2012 that 8 killed in blast at fire works unit in Salem district. Three children among those dead proves beyond doubt that child labourer practiced in fire unit in Parakkallur village of Mecheri panchayat. Their work place is also not safe for them. This is the plight of children at large who are child labourers.

Presence of bad traits in teachers invariably spoiled the students performance and over all personality. Teachers must be trained to handle students as nurses are trained to handle patients. Only such trained and devoted teachers can reduce the school dropout.

Teachers must be inspected regularly by government authorities so that they properly treat the children which can prevent school dropouts.

Another reason for school dropouts are that the teachers not knowing the emotional feelings of the children punish them

very badly in class like stripping them, making them do sit ups, asking them to stand on bench or beat them. All these acts of violence and abuse have a very strong impact on these children which in many cases may lead to school dropouts.

Thus the study strongly revealed that there is something lacking in our school education system.

Final suggestion is that school dropouts can be minimized by devoted teachers who motivate the children at the tender formative age.

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